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AMERICAN VETERINARY REVIEW,

JULY, 1889.

EDITORIAL.

PNEUMO-ENTERITIS one of the special forms of swine scourges—it prevails in Europe—existed in England—has been observed in France—Klein, Cornil and Chantemesse, the European investigators—the search for a vaccine—the failures—F. S. Billings, (of Nebraska) claims—how successful has he been?—An experiment *a la Pouilly-le-Fort* wanted—the last word on the nature of the disease not yet told—Prof. Galtier's remarks—his investigations of an outbreak in Southern France—his report—his conclusions—sheep subject to a disease similar to pneumo-enteritis in swine—the same disease is inoculable to all farm animals—a third series of experiments shows that it can produce various affections—in cows—in calves—in horses—serious statements advanced by the learned professor—they need confirmation, if they can be confirmed—has the correct and complete biology of the microbe been studied?—has the Professor been too hasty?

THE PNEUMO-ENTERITIS OF SWINE, one of the special forms of swine scourges which prevail so extensively in this country, principally in our western regions, and which is constantly causing an amount of pecuniary loss to the country which no statistics can define, and which has been the subject of no end of scientific, and even personal discussion, is not confined in its ravages within the boundaries of the American Continent, but prevails also more or less widely throughout Europe. It was, in fact, due to the labors of the English pathologist, Klein, that the scientific world first became acquainted with the nature of its specific lesions, and Continental investigators also have recently had their attention called in the same direction. Cornil and Chantemesse, in France, have prosecuted their investigations and continued their studies during the late outbreak in Southern France, and a portion of the results of their labors is recorded in an interesting report of their observations contained in the

Comptes Rendus, a striking agreement being observable between the views thus propounded, and the statements and discoveries with which we have become familiar in the results of experiments and researches on this side of the Atlantic.

The great objective point of the investigations of our scientists in the present instance, is of course, the discovery of some sure method of prophylaxy against this widespread and persistent evil. But all the labors of all the pathologists, biologists, and others who have joined in the pursuit of a neutralizing or counteracting virus, or what not, have hitherto, so far as we know, proved to be abortive. The most assiduous and intelligent laborers in this important field have failed to reach a conclusion which may be considered as of positive value. In the view of those who are most familiar with this peculiar line of work, this has been about the *status quo* at the present time, of this interesting question.

But Dr. F. S. Billings, late of the University of Nebraska, now claims to have made the great discovery of a prophylactic, and if we are to believe the reports and the letters which are found in some of the Western papers, such good and *positive* results have been obtained as quite to justify the application of the new inoculation on a large scale. If this is confirmed, we most heartily congratulate the Doctor on his achievement, but it seems to us that an experiment *a la Pouilly-le Fort*, imposes itself for his reputation as well as for the success of his claims.

But the last word does not seem to be yet spoken in respect to the nature of this disease, its peculiar mode of distribution and the peculiarities of its biological features. Even the correctness of its terminology is questioned, and if we are to accept the results of the recent experiments made by Professor Galtier of Lyons, and to trust to the reports that appear in the French veterinary periodicals, the bacillus which produces pneumo-enteritis in swine is not specific to this animal. Having been appointed to study an outbreak of disease amongst sheep in a southern part of France, Professor Galtier reported to the Secretary of Agriculture that "the lesions observed were those of pneumo-enteritis; exudative

peritonitis, inflammation and ulceration of the intestines, congestion and œdema of the lungs, lobular isolated pneumonia, hypertrophy and softening of the bronchial ganglions." Also, "that in the infected farms, the diseased sheep had cohabited with swine affected with pneumo-enteritis; that in others they had been in contact with diseased hogs, or exposed to their dejections," and "that in all the lesions, a short bacteria had been found, whose morphology and cultures were very analogous, if not identical with the bacteria of hog cholera."

All this seems very well, but American and European observers seem to deny the transmission of hog cholera to sheep either by the inoculation of the cultures or that of the virus proper.

But there was more coming. Professor Galtier had promised to continue his researches, and he kept his word, and in reporting to the *Academie des Sciences* he declares that he has successfully inoculated rabbits, pigs, guinea pigs, sheep, goats, dogs and fowls with the virus which he had obtained from the sheep he had seen in the southern part of France, and that comparative inoculation made on the same various species of animals with the virus of pigs sick with pneumo-enteritis had given him the same results. His conclusions fix the perfect identity of the disease of the sheep with the hog cholera of swine.

Again, in a third series of experiments, Professor Galtier says that the disease of the sheep which he had studied is transmissible to all farm animals, and that it may produce *epizootic abortion* in cows and *broncho pneumonia* in young calves, and that in some cases it has been described as a *typhoid affection* of horses.

These statements are of an important character, and indicate a state of things differing so totally from what has been hitherto known and admitted as tested fact, that we feel justified in expressing a fear that Professor Galtier has been hasty in his conclusions and probably has not paid sufficient attention to one especial point in the study, nor considered it as thoroughly as ought always to be done in similar zymotic affections: viz., the *correct and complete biology of the microbe he has found*.

ORIGINAL ARTICLES.

ÆTIOLOGY OF TUBERCULOSIS.

By DR. R. KOCH, Privy Councillor.

(Translated by Rev. F. SAURE.)

(Transactions of the Massachusetts Veterinary Medical Association.)

(Continued from page 130.)

A very different image is presented by the culture developing from substances which contain only scattered bacilli. As has already been suggested, one does not succeed in such cases in freeing the bacilli by rubbing and crushing the substance, and spreading it on the surface of the serum. They remain, in the substance and form there colonies which grow almost to the size of a poppy seed. In such cases there can be no doubt that each single little colony proceeded from one single, or at most two bacilli, because microscopic investigation has always found only 1-2 bacilli in a giant cell of the tissue in question. Accordingly we can also further conclude that, in the formerly mentioned examples, the single scales developing upon the serum proceeded also from single bacilli.

If a beginning of reinculture of tuberculous bacilli has been obtained in the manner just described, they can be carried on without difficulty. For this purpose some of the whitish scales can be put into a re-agent glass containing stiffened serum by means of the platinum wire, which must be made glowing hot and then cooled again, immediately before its use. By the use of this wire the scales are also to be spread as much as possible on the serum surface, and rubbed to pieces. In this second sowing far more numerous bacilli reach the serum surface, and can there be spread more easily and evenly than was the case with the original inoculating material; in consequence of which one obtains in this and later breedings, no longer single scales, but coherent, membrane-like colonies. These take in general the figure which the motions of the platinum wire prescribed beforehand in the sowing. They can therefore be laid on in lines, either in a perpendicular or horizontal direction, or may take any figure one may choose to construct on the serum. Vigorously growing cultures nevertheless spread more or less beyond the original limits of the sowing. This spread is, however, not the consequence of independent motions of the bacilli, which, as already shown, they do not possess, but it takes place in consequence of the fact that in the constant increase of the bacilli the increase of mass does not take place in the diameter of the thickness, but in area. The growing bacilli do not heap themselves upon each other, but have the tendency to spread out in area and push the already formed coherent membrane away over the surface of the serum. This is most marked when the bacilli membrane reaches the liquid at the base of the re-agent glass. It does not penetrate into the liquid, but it forces itself over the same and forms a fine cover on the surface of the liquid. Very often indeed it presses up to a height of some millimeters on the opposite side of the glass.

The bacilli "culture" have other noteworthy qualities by which they may be distinguished from other bacteria "culture" by the naked eye. In the first

place, they never liquify the serum, as some sorts of bacteria regularly do. They do not penetrate into the serum, but always remain on its surface and lie loosely there. In consequence of this the membrane-like bacilli vegetation can be lifted and washed away by tipping the re-agent glass so that the liquid at its base may flow over the surface of the serum. Other bacteria possess a pap-like consistence and let themselves mingle with the liquid, making them cloudy. This is not the case with tuberculous bacilli. The thin membranes formed by them do not dissolve in the liquid, but in consequence of their firm consistence break into larger or smaller lumps, which are washed away by the liquid, and finally collect at the bottom of the same. The peculiar stiff and brittle constitution of the colonies shows itself best in the part of the "cultur" which covers over the liquid in the re-agent glass. As soon as this liquid is set in motion the little skin on its surface breaks into plates and lumps, which slowly sink to the bottom. The liquid always remains clear, as well when the bacilli vegetation itself stretches over it, as when by washing off of the serum surface masses of bacilli get into it, or when in the beginning the inoculating substance is intentionally put into it. From this appearance also we should conclude, as direct observation had already shown, that the tuberculous bacilli possess no independent motion; for bacilli which can move disperse themselves in all directions through the breeding solutions, and give them a cloudy appearance.

Within certain limits, moreover, the conduct of the bacilli "cuturen," as seen by the naked eye, depends upon the consistence of the blood serum upon which they grow. The firmer that is, the more the bacilli colonies have the constitution just described. On a very soft gelatinous serum the development is somewhat different. The distribution of the bacilli is not uniform because the hard and firmly coherent masses of bacilli cannot be crushed on the soft serum in the sowing. The inoculating substance therefore remains lying on the serum in small detached crumbs. The growth of the colonies does not reach so uniformly over the surface as on the firm serum, but leads to thicker compact masses which cling firmly to the soft serum. Even when the serum is somewhat less soft, so that the colonies begin to spread themselves out on the surface, one notices a firmer attachment of the bacilli membrane to the serum area. One does not then succeed in washing the membrane from the serum, or lifting it off with the platinum wire, without at the same time loosening parts of the serum.

When even the properties of the "cuturen" noticeable with the naked eye show a difference from other bacteria and admit a judgment as to their purity, this is much more the case when they are examined under a moderately strong magnifying power, such as is obtained with Zeiss' Objective System, A.A., ocular 4, with drawn out tube, (80 fold magnifying power). It is then seen that the bacilli colonies form such peculiarly shaped figures as do no other sort of bacteria. Microscopically of course these colonies can be noticed far earlier than with the naked eye. Already five to six days after the sowing takes place and the "cultur" has been kept at breeding warmth, peculiar, very dainty little figures appear on the surface of the serum. These appear as fine lines, often bow-shaped. The smallest have mostly the figure of an S. Longer colonies show the most manifold serpentine turns and windings which often remind one of interlacing letters. While the ends of these lines run off into sharp points, in the middle they are

more or less swollen to a spindle shape, and the smaller younger colonies are extraordinarily thin and delicate, the older thicker and of heavier forms. Gradually, by continued spreading and melting together, the windings take more and more a plate-like form which, by the ware-like designs and the transition of their borders into the peculiar oscillating lines of the single colonies, allow their origin as such to be recognized. Finally a number of such plates melt into each other, and form the previously described membrane-like bacilli colonies, while the plates proceeding from single colonies correspond with the whitish scales visible to the naked eye. In order to examine the colonies directly under the microscope and to follow their development, four-cornered little glass basins provided with a glass cover are specially adapted.

That these colonies are only formed by the tuberculous bacilli is soon seen when they are colored by Ehrlich's method, and examined by strong magnifying power. This can be done most practically when one presses a covering glass firmly to the surface of the serum covered with colonies and takes it up again. Numerous colonies then remain clinging to the covering glass in their natural arrangement and grouping, dry there and can be colored as was described formerly in the directions for covering glass specimens. The bacilli are not thrown together without method, but are placed with their axes of length parallel with the axis of length of colony. It is striking that the bacilli do not touch each other, but are separated, though only by slight spaces. As was formerly suggested, one may conclude from this conduct that the bacilli are surrounded by a building substance and are joined together by this, as is proved by the firm coherence of the colonies. Very frequently in farther advanced colonies one finds all or nearly all the bacilli spore-bearing.

Usually the "culturen" have reached the maximum of their development after four weeks and then remain unchanged. The continuation of the same is most practically carried on in intervals of from two to four weeks. Nevertheless such "culturen" as have existed for months are still capable of development and can be used for further breeding. By the method described in the above I have gained a number of reinculturen of tuberculous bacilli from different materials, and have continued them through a longer or shorter succession of breedings. Several attempts at "culturen," and indeed the first which were made, proceeded from guinea-pigs, which were tuberculously infected by inoculation from man and from various animals. Other "culturen" have been obtained directly from the original tuberculous material. The reinculturen indirectly gained by the help of the original inoculation of guinea-pigs relate to the following cases:

- 1.—Human lung-phthisis cultivated through twenty-two months, therefore almost two years, in thirty-four successive breedings;
- 2.—Human lung-phthisis (caseous mass from the lung) cultivated for two and one-half months in five successive breedings;
- 3.—Human lung-phthisis (contents of the lung cavity) cultivated for three months in six successive breedings;
- 4.—Human miliary tuberculosis (tubercle of the lung) cultivated for seven months in twelve successive breedings;
- 5.—Human miliary tuberculosis (tubercle of the pia mater) cultivated for three months in five successive breedings;

- 6.—Human miliary tuberculosis (tubercle of the spleen) cultivated for two and one-half months in four successive breedings;
 - 7.—Human tuberculosis of the uterus cultivated for four months in six successive breedings;
 - 8.—Human intestinal tuberculosis (caseous mesentric glands) cultivated for six months in nine successive breedings;
 - 9.—Human lung-phthisis (sputum) cultivated for four and one-half months in seven successive breedings;
 - 10.—Scrofula in man (excised neck-gland) cultivated for seven months in twelve successive breedings;
 - 11.—Tuberculosis in monkey (lung-tubercle) cultivated for six and one-half months in twelve successive breedings;
 - 12.—Tuberculosis in monkey (tubercle of the spleen) cultivated for seven months in thirteen successive breedings;
 - 13.—Tuberculosis in monkey (caseous bronchial glands) cultivated for four months in six successive breedings;
 - 14.—Tuberculosis of cattle (pleura knots) cultivated for three months in five successive breedings;
 - 15.—Tuberculosis of cattle (pleura knots) cultivated for three and one-half months in five successive breedings;
 - 16.—Tuberculosis of cattle (peritoneal knots) cultivated for twenty-one months in twenty-nine successive breedings;
 - 17.—Tuberculosis of cattle (peritoneal knots) cultivated for three months in five successive breedings;
 - 18.—Tuberculosis of cattle (knots from the diaphragm) cultivated for four months in six successive breedings;
 - 19.—Tuberculosis of cattle (pap-like caseous masses from the lung, first case) cultivated for eight months in thirteen successive breedings;
 - 20.—Tuberculosis of cattle (pap-like caseous masses from the lung, second case) cultivated for three months in five successive breedings;
 - 21.—Tuberculous bacilli "cultur" (Nos. 1 and 5 breeding) cultivated for four months in seven successive breedings;
- The following reinculturen were obtained directly from the tuberculous material:
- 22.—Miliary tuberculosis from man (tubercle of the lung) cultivated for nineteen months in twenty-four successive breedings;
 - 23.—Miliary tuberculosis from man (tubercle of the lung) cultivated for six months in ten successive breedings;
 - 24.—Lung-phthisis from man (contents of a cavity) cultivated for seven months in eleven successive breedings;
 - 25.—Lung-phthisis from man (contents of a little cavity in the tip of lungs) cultivated for eight months in ten successive breedings;
 - 26.—Lung-phthisis of man (contents of a closed cavity) cultivated for eighteen months in twenty-four successive breedings;
 - 27.—Caseous pneumonia of man (lung-tissue) cultivated for five months in seven successive breedings.
 - 28.—Caseous pneumonia of man (lung tissue) cultivated for seven months in nine successive breedings;

29.—Scrofulous gland cultivated for six months in seven successive breedings;

30.—Scrofulous gland cultivated for five months in seven successive breedings;

31.—Scrofulous gland cultivated for three months in three successive breedings;

32.—Scrofulous gland cultivated for three months in four successive breedings;

33.—Tuberculous testicles cultivated for four months in six successive breedings;

34.—Fungous joint cultivated for fifteen months in nineteen successive breedings;

35.—Lupus cultivated for sixteen months in twenty-one successive breedings;

36.—Lung from cattle-tuberculosis (caseous mass) cultivated for six months in eight successive breedings;

37.—Lung from domestic animal tuberculosis (calcined knots) cultivated for five months in seven successive breedings;

38.—Knots from the diaphragm of a tuberculously diseased domestic animal cultivated for nine months in fifteen successive breedings;

39.—Knots from the pericardium of a tuberculously diseased domestic animal cultivated for eighteen months in twenty-three successive breedings;

40.—Caseous pneumonia of the pig cultivated for five months in eight successive breedings;

41.—Spontaneous tuberculosis of guinea pig (knots from the lungs) cultivated for six months in nine successive breedings;

42.—Spontaneous tuberculosis of the guinea pig (spleen) cultivated for three months in five successive breedings;

43.—Spontaneous tuberculosis of the guinea pig (knots from the lung) cultivated for four months in seven successive breedings.

The preservation of the culture demands such an expenditure of time and trouble, that always only a certain number can be maintained at the same time. I let the most of them perish again as soon as their vegetative disease-producing qualities had been sufficiently established by a "culture" continued for several months, and by the inoculations undertaken with it. Only the Culture No. 1 (lung-phthisis), No. 16 (tuberculosis of a domestic animal), No. 22 (miliary tuberculosis), No. 26 (contents of a cavity from a phthisical lung), No. 31 (fungous joint), No. 35 (lupus), No. 39 (tuberculosis of a domestic animal) have been continued until now, and are to be further preserved in order to find out whether in the life of the tuberculous bacilli continued outside of the animal body some sort of changes may not occur in their qualities. It might appear strange that comparatively so large a number of "culture" were established, when a few would have sufficed for observing the conduct of the bacilli in the "culture." Nevertheless in the beginning it appeared to me by no means impossible, that although the bacilli of the various tuberculous forms,—lupus, phthisis etc.—showed microscopically no difference, the bacilli derived from the various sources might perhaps manifest differences in the culture. But in spite of the closest attention directed to this point, I have been able to find nothing of the kind. In the "culture" also,

whether taken from miliary tubercles or from the contents of vomicae, often lupus, often tuberculosis of domestic animals, the tuberculous bacilli have been completely uniform in their conduct. In no way has a change made itself noticed in the "culture" continued for a longer period, between sixteen and twenty-two months. If I formally made the claim that the culture of tuberculous bacilli possess especially characteristic properties, by means of which the tuberculous bacilli could be distinguished from other bacteria, almost with greater certainty and certainly with more important grounds than by means of their tinctorial qualities, I can in confirmation of this claim appeal to a very rich amount of examined material. There were, namely, after the favorable properties of the stiffened blood serum were recognized, numberless attempts made, partly from reinculture of various bacteria, partly from the sowing of the most various animal substances on blood serum, but vegetations which resembled the culture of tuberculous bacilli never appeared. These attempts belonging, to be sure, to other experimental investigations, form counter-attempts, from which we see that the above described characteristic cultures are only to be obtained from substances which contain tuberculous bacilli.

It must still be of special significance for ætiology to determine whether the tuberculous bacilli can grow and multiply under conditions which make possible to them an existence independent from the body of man and of the animals. For the decision of this question it was first necessary to examine whether the bacilli only grow on the stiffened blood serum or whether they also flourish in other nourishing media. Attempts with liquid sterilized blood serum gave the result, that little particles of bacilli-culture, which were put on the surface of the serum in a re-agent glass, developed themselves in the way already described, just as on the surface of the liquid beside the stiffened blood serum, and formed a thin whitish coating, which was of a fragile, brittle consistence, and which broke in moving the serum and sank to the bottom. The serum always remained clear. When I did not succeed in keeping the sowed substance floating on the surface of the serum, when it sank into the liquid, the result was no noticeable increase of the sowed pieces.

The blood serum of various sorts of animals showed, as well in a stiffened as in a liquid condition, no essential difference in the power of serving as breeding ground for the tuberculous bacilli. They appear, to be sure, to flourish best on the serum of sheep, cattle and calves. But the serum of horse and swine blood gives very vigorous culture. Even on the serum of dogs blood the culture do not grow noticeably less vigorously, in spite of the fact that this species of animals is quite resistant to tuberculosis. On the contrary, tuberculous bacilli do not grow on the white of eggs. At first I did not succeed in bringing about the growth of tuberculous bacilli in other liquids than blood serum. When one or more crumbs of a culture were put into a glass with neutralized meat-broth, the crumbs certainly appeared in the course of four or five weeks to have increased somewhat in size, but it was difficult to decide whether a real growth had taken place. Not until I had broken the pieces of the bacilli-culture and rubbed them fine, put them into the meat-infusion and by frequent shaking dispersed them through it, that an undeniable development took place. It does not appear to be unimportant for the success of this attempt, that the culture should be placed in glass alembics with a broad,

level base—so-called Erlenmeyer alembics—and only so much liquid put into the alembic as that the bottom be covered from one half to at most the depth of a centimeter. The meat-infusion always remained clear, but in the course of four or five weeks a fine-grained sand-like looking white layer formed at the bottom of the vessel. The single little grains, which had probably grown from the scarcely visible particles of the sowed substance, consisted exclusively of tuberculous bacilli.

If one compares this conduct of the cultures in liquid nourishing media, namely their slow growth and the constant clearness of the liquid, with the reports of former culture attempts from Klebs, Schüller, Toussaint (who noticed after from one to three days a cloudiness of the culture-liquid) one cannot resist the conviction that these cultures could not have been reincultures.

Also in regard to the meat-infusion the phenomenon is repeated, that the flesh of various animals and even of such as are only slightly susceptible to tuberculosis—as dog, cat and domestic mouse—allow the cultures to develop in almost equal strength. It is to be mentioned that neutralized meat-infusion stiffened by an addition of Chinese gelatine, and thereby changed into a firm breeding ground, which can be exposed to the breeding temperature without becoming liquid, also gives a breeding ground for tuberculous bacilli cultures. This is, to be sure, considerably inferior to the stiffened blood serum, because on the slippery surface the bacilli can not be spread out well, and in consequence of this the characteristic membranous cultures are not developed, but instead compact, irregular masses. Since some disease-producing bacteria—for example inflammation-of-the-spleen bacilli, typhus bacilli, glanders bacilli and erysipelas micrococci—grow very vigorously on vegetable substances—for example especially on boiled potatoes—attempts were made in this direction with tuberculous bacilli also, but they have led to no positive results. All in all, therefore, no great scope is offered the tuberculous bacilli in regard to breeding ground.

There are similar limitations with regard to a second condition essential for the existence of bacteria, with the limits of temperature within which growth takes place.

In often repeated attempts it resulted that in a temperature of 42° C. in the course of three weeks no growth took place. Further, in 30° C. the development is very slight and ceases completely between 28° and 29° C. The cultures thrive best in a temperature of 37° to 38° C. A considerably wider range of temperature, within which they can increase, stands at the disposal of other disease-producing bacteria. The inflammation-of-the-spleen bacilli, for example, grow very luxuriantly between 20° and 24° C., and form spores in a short time. They can thrive also up to 43° C. If we take into consideration that the anthrax-bacilli can run the entire course of their development to spore formation in twenty-four to forty-eight hours, in a temperature which in summer is often reached by the surface of the ground, and that they can do this on dead vegetable substrata, the supposition is justified that they can run their course of development in suitable places out of doors and independently of the animal body. No further explanation is necessary to show that, owing to this, the ætiology of anthrax takes an altogether different shape than if the anthrax-bacilli in their existence were dependent alone upon the animal body. The same would hold good of the tuberculous bacilli, if they could grow on breeding substrata such as occur in nature and if they could

develop and form spores in a comparatively short time in a temperature corresponding to summer warmth. But this is not the case. The lowest limit of temperature in which the tuberculous bacilli are able to grow is not reached by the summer temperature; also, the growth of these bacteria goes on so slowly that they would be crowded out by the much more quickly developing sorts of bacteria everywhere appearing before they had finished their course of development. Even if, therefore, other more easily obtainable substrata than those of an animal nature were found, which could serve the tuberculous bacilli as breeding ground, nevertheless the last mentioned reasons would speak decisively against the supposition that the tuberculous bacilli could lead an existence independent of the animal organism. We are, therefore, compelled, so far as our experience reaches, to consider the tuberculous bacilli not as bacilli which can grow anywhere, but as genuine parasites, that is such as can find the conditions of their existence only in the animal or human organism.

D.—ATTEMPTS AT INFECTION.

These attempts until recently have formed the most important part of the experimental investigations concerning tuberculosis. But although these have been carried on in a very extensive manner, they lack, except in a few instances, the prudential measures which must necessarily be united with them to make them free from objection.

There are three sources of error which can raise a doubt in regard to the attempt at infection. First, mistaking spontaneous tuberculosis for the tuberculosis artificially created by infection. Second, the mistaking of products of genuine tuberculous disease for pathological changes, which with the naked eye or even microscopically, more or less resemble them. Third, unintentional infection with tuberculous virus by means of infected instruments, inoculating material, etc., in short through the neglect of antiseptic prudential measures. How shall one protect himself against these sources of error? To avoid the errors arising from spontaneous tuberculosis, it has been suggested that one experiment only with those animals in which tuberculosis seldom or never occurs. But since animals in which no spontaneous tuberculosis occurs are always more or less indisposed to this disease, and therefore furnish no reliable reagent for the effect of the tuberculous virus, this proposition is practically not feasible. Also for attempts in anthrax infection one would, for example, not chose for exclusive use dogs, which, as is well known, are almost exempt from this disease; but, on the contrary, experiment with animals which are as sensitive as possible to anthrax-infection. The same holds of attempts at infection with tuberculosis. The more sensitive, therefore, a kind of animal is to infection with tuberculous virus, so much the better it is adapted to the infectious attempts in question. Nevertheless only under the condition that one succeeds in keeping the artificial and the spontaneous infection separate in the animals used for experiment. With some little attention this is not so difficult. The characteristic marks by which the two are to be distinguished have already been given in detail. It is self-evident, however, that, even though by means of these characteristics spontaneous tuberculosis be excluded as a cause of mistake, all prudential measures should be taken to confine the spontaneous disease to as narrow a field as possible. This may be attained by separation of the tuberculous animals in different cages, by frequent airing, cleaning and disinfecting of the stalls. Never-

theless it is not advisable permanently to keep rabbits and guinea pigs in the same rooms that contain tuberculous animals; they would scarcely remain free from tuberculosis longer than eight to ten months in infected stalls. In one case a number of animals were kept as long as possible by way of experimenting on their immunity, but in spite of the best care only here and there one remained free from tuberculosis for more than a year, and even these a few months later also became victims to the disease. After all these experiences, all the numerous experiments in which tuberculosis was conclusively shown, have little or no force as proof unless the product itself should make manifest that a spontaneous tuberculosis exists or can be excluded.

As to the second source of mistake, the confusing of non-tuberculous knots with genuine tubercles, nothing is simpler than to exclude the same. The genuine tubercles are infectious and contain tuberculous bacilli; the false do not. Even if one will not admit the diagnostic worth of tuberculous bacilli, one must distinguish between infectious and non-infectious knots. Therefore, if by an attempt at infection, for example if by the inhalation of any substance, some little grey knots be caused in the lung of a dog, one may not content himself with this simple result, and resting upon this claim that these are genuine tubercles. Under all circumstances the infectious nature of such little knots must be proved. Where genuine tuberculosis is concerned one is generally spared the trouble of especially proving their infectious nature by inoculation with the knots, for in this case the disease seldom shows itself confined to one spot; almost always it has already attacked other organs of the body, itself furnishing proof of its infectious nature by its propagating ability. Therefore, when the formation of tubercles stretches itself out past the original infectious spot into the lymph glands, lungs, liver and spleen, it can without further proof be considered infectious. If, as is, for example, the case after the inhalation of non-virulent firm particles into the lungs, and after the injection of granular masses into the "bauchhöhle" (belly cavity) in the peritoneum, the knots caused by this remained confined to the place of infection (here the lungs and peritoneum) and show no inclination to further infection of the body, then this circumstance speaks against the inference that genuine tubercles exist here, and special proof of their infectious nature must be furnished. If this is not done, as it, in an incomprehensible manner, has not been in several of the newer investigations undertaken to prove the non-infectious nature of tuberculosis, then the real proof is lacking in the experiment.

The third mistake mentioned, the unintentional infection by means of instruments, etc., appears to have clung to almost all former investigations with regard to tuberculosis to a greater or less degree, whether such investigations were directed towards proving or disproving its infectious nature. And yet this mistake may be avoided without great difficulty if one holds to the rules concerning antiseptic operations, and above all things carefully disinfects the instrument for every single attempt. All metal instruments, such as scissors, pincers, knives, inoculating lancets, must be heated thoroughly. Special care is demanded in the treatment of the syringes used for injection. Syringes, of ordinary construction cannot be disinfected with sufficient certainty, because they do not admit a high degree of heat without being injured, and liquid means of disinfection, as shown by experience, do not certainly destroy the infectious

material in the interior of the syringe and especially that clinging to the puncturing apparatus. Hence the syringes must have a special construction which makes their disinfection by heat possible. For this purpose the syringe must be made of glass and metal. The lower end of the same must be made to have an air-tight connection with the framework of the needle by means of a cork plate, set in and bored through; and the piston must be wound with a soft cotton thread. In this form the syringe can, before every experiment, be made free from infectious germs by an hour's heating at 150° to 160° C. The piston is then moistened by absorbing boiled distilled water, and if the enwrapping is done with some care, it becomes as tight as by the use of the ordinary leather or gutta percha piston.* The hands of the experimenter are to be disinfected with a one per cent. sublimate solution, and of course everything else is to be avoided which could lead to an unintentional infection of the animal to be experimented on during or after the operation.

By all the attempts at infection to be mentioned in what follows, the prudential measures just explained were strictly carried out and, therefore, to speak again of the latter, for every attempt several freshly bought animals were used and kept in separate cages, the effect of the infection was proved so early, that a confusion with the later appearing spontaneous tuberculosis could not occur; further, the tuberculous changes appearing in consequence of the infection were always studied with reference to the presence of tuberculous bacilli, and where it seemed necessary, also especially with reference to their infectious qualities. The infection itself took place with antiseptic precaution and especially with reliably disinfected instruments.

The attempts at infection carried out in the course of my investigations regarding tuberculosis fall into two groups. To the one group belong those attempts in which tuberculous bacilli-bearing parts of tissue were used; to the second, those in which reinculture of tuberculous bacilli were the infectious material.

E.—ATTEMPTS AT INFECTION WITH TUBERCULOUS BACILLI-BEARING TISSUES.

These served partly for studying the effects of the products of various sorts of tuberculous processes, partly to gain suitable sowing-material for the beginning of reinculture. As inoculating material there were used pieces of tissue from various organs of humaniliary tuberculosis, from phthisic lungs, various forms of localized tuberculosis, from fungous joints, scrofulous glands, lupus, tuberculosis of various animals. The inoculating material was always examined with reference to its contents of tuberculous bacilli. The inoculation took place in this manner: In guinea pigs a small cut was made with the shears into the belly and by the use of the points of the shears a pocket-shaped subcutaneous wound about one half ctm. deep was made in this cut. Into this little skin pocket a little piece of the inoculating substance, varying in size from a grain of millet to a mustard-seed, was pushed in as deeply as possible. On the following day the inoculation wound always appeared closed and showed no reaction. Usually a noticeable swelling of the lymph-glands lying next to the point of inoculation, usually of the inguinal glands on one side, first appears after two weeks and at the same time a harden-

*Syringes of this construction are furnished by H. Windler, court instrument maker, Berlin, N. W. Dorotheenstrasse 3.

ing and knot-forming showed itself upon the up-to-that-time completely healed inoculation-wound. After this the enlargement of the lymph-glands increased rapidly, often to the size of a hazel nut. The knot at the point of inoculation then mostly broke out and covered itself with a dry crust, under which was a flat abscess not discharging much pus and provided with a caseous base. The animals then began to grow emaciated, to have rough hair and difficulty in breathing and died usually from the fourth to the eight week, or were killed within this period. Also in the case of rabbits the inoculating substance was a few times put into a pocket-shaped skin-wound. But since the course of the disease did not run so precisely and so quickly after the subcutaneous inoculation as was the case with guinea pigs, I afterwards chose the anterior eye chamber as the point of inoculation in rabbits. The course of the iris-tuberculosis arising in consequence of this inoculation has been described often and therefore does not need a special description. The following inoculations were carried out in this manner:

1. *Miliary tuberculosis*.—Tuberculous knots of the pia mater, very rich in tuberculous bacilli: six guinea pigs. Of these one died in five weeks, two in six weeks, two in seven weeks after the inoculation. The sixth was killed in the eighth week. In all the animals the lungs, liver and spleen were tuberculous in a high degree and the inguinal glands were caseous.

2. *Miliary tuberculosis*.—Grey little knots of the lung, quite rich in tuberculous bacilli: six guinea pigs. Three died in the sixth week, the others were killed a few days later. All tuberculous as in No. 1.

3. *Miliary tuberculosis*.—Grey yellow knots from the spleen and kidney, not very rich in tuberculous bacilli: six guinea pigs. Died in the sixth and seventh week. All tuberculous as in No. 1.

4. *Miliary tuberculosis*.—Grey knots of the lung, quite rich in bacilli: three guinea pigs. Two died in the sixth, one in the seventh week. All tuberculous as in No. 1.

5. *Miliary tuberculosis*.—Grey knots of the lung containing few bacilli; five guinea pigs, two rabbits at the "root of the ear." One guinea pig died after eight weeks, the others were killed a few days later. All tuberculous. The rabbits killed after ten weeks had caseous lymph-glands at the root of the ear and on the neck, quite a number of grey little knots in the lungs and some knots in the kidneys and in the spleen. Five guinea pigs were inoculated with tubercles from the spleen of one of the guinea pigs. Of these three died in the eighth week, the other two were killed in the same week and all found tuberculous. Further, the caseous gland substance of the rabbits rubbed in water, was injected into the belly cavity of two rabbits. When these animals were killed eight weeks later, tuberculosis of the omentum, spleen and liver existed as also quite a number of grey knots in both lungs.

6. *Caseous pneumonia and tuberculosis of the brain-membranes*.—Two guinea pigs with the bacilli-rich lung-substance, one guinea pig with a piece of the tuberculously infiltrated and bacilli-rich pia mater. The animals died in the fifth and sixth week. Both tuberculous.

7. *Caseously infiltrated lung*.—Six guinea pigs. The first died after six weeks. The others were already very sick and were killed on the following day. All tuberculous.

8. *Phthisic lung with vomica, intestinal abscesses and caseous mesenteric glands.*—With the contents of one vomica, which contained quite a number of bacilli, two guinea pigs were inoculated, and four with the very bacilli-rich substance of the mesenteric glands. The last died in the course of the fifth and sixth weeks, of the first two one died in the sixth week, the other was killed a few days later. All tuberculous.

9. *Caseous bronchitis and intestinal tuberculosis.*—With the moderately bacilli-rich lung substance, five guinea pigs were inoculated. Two of them died in the eighth week; the others were killed before the end of the same week. All tuberculous.

10. *A phthisic lung containing vomica.*—With thickened lung tissue which contained a few bacilli, four guinea pigs were inoculated. Of these, three died in the seventh and eighth weeks, the last not until the twelfth week. All tuberculous.

11. *Phthisic sputum.* More or less bacilli-rich sputum freshly taken from three different sufferers from phthisis was inoculated at different times into nine guinea pigs. The animals died, part before the eighth week, the others were then killed. They were all tuberculous.

12. *Phthisic sputum dried for two weeks.*—Three guinea pigs. Two died in sixth week, third was then killed. All tuberculous.

13. *Phthisic sputum dried for two months.*—Three guinea pigs. Killed after five weeks and found with tuberculosis in lungs, liver and spleen.

14. *Tuberculosis of the uterus and "tuben."*—Caseous substance from the tuben inoculated into six guinea pigs. Two animals died after seven weeks. The others were killed in nine weeks. All tuberculous.

15. *Pus from a tuberculous abscess of the kidneys.*—Two guinea pigs were subcutaneously inoculated with it, and two suffered an injection into the cavity of the belly. The animals were killed after five weeks. In the guinea pigs subcutaneously inoculated, the inguinal glands were swollen and beginning to be caseous; in the enlarged spleen were numerous, in the lungs few, little grey knots. The injected guinea pigs had many tuberculous knots on the peritoneum and in the omentum; spleen more strongly tuberculous than in the inoculated animals, also larger and more numerous tubercles in the lungs.

16.—*Pus from a congestion-abscess occasioned by aorta-caries.*—Five guinea pigs received from it an injection into the belly cavity. The same boiled distilled water which served for thinning the pus was injected into the belly cavity of one guinea pig which served as control-thier (animal to prove whether association with infected animals would give the disease). This animal was left in the same cage with the others. The animals were killed in the seventh week. The "control-thier" had not a trace of tuberculosis either in the belly cavity or in the lungs. The animals into which the pus was injected showed a remarkably fine tuberculosis of the peritoneum and of the omentum, besides this also a more or less advanced tuberculosis of the spleen and lung.

17.—*Fungous elbow-joint.*—Substance with very few bacilli inoculated into four guinea pigs. Killed in the tenth week. All tuberculous.

18.—*Scrofulous glands* from three different cases inoculated into ten guinea pigs at different times. The inoculating substance contained few bacilli and cor-

responding with this the tuberculosis ran its course much more slowly. Nevertheless also in these animals, the swelling, the first noticeable symptom of disease, and the later caseous degeneration of the inguinal glands, leave no doubt that the place of inoculation formed the point of entrance for the tuberculous virus. Four of the animals died from the tenth to the twelfth week, the others were then killed. In all the lymph glands in the neighborhood of the place of inoculation were caseous, and the spleen, liver and lungs tuberculous to a marked degree.

19.—*Scrofulous gland*.—The gland substance, poor in bacilli, transferred into the anterior eye chamber of four rabbits. In all four animals in the course of the third week, tuberculosis of the iris began to develop and lead to caseous degeneration of the bulbus. In the tenth week the rabbits were killed and beside the destruction of the bulbus, caseous degeneration of the neck lymph-glands and numerous grey knots were found in the lungs.

20.—From five different cases of *lupus* eighteen rabbits were inoculated in the anterior eye-chamber. The course of the disease corresponded exactly with that described in No. 19. An iris-tuberculosis at first developing slowly, gradually leading to caseous degeneration and suppuration of the bulbus and finally to general tuberculosis. The inoculation was without results in the case of one of the rabbits. Some were killed just when the iris tuberculosis had developed, others after the swelling and caseous degeneration of the neck-glands had appeared; still others finally died with wide-spread tuberculosis of the lung, liver, spleen and kidneys. As well in the tubercles of the iris as in the tuberculously altered glands, lungs, etc., tuberculous bacilli were proved more or less abundantly. From a sixth *lupus* case three guinea pigs, and from one of the above mentioned cases five guinea pigs were subcutaneously inoculated. In these animals also there were swelling and caseous degeneration of the inguinal glands. They died in the seventh to the eighth week after the inoculation, were tuberculous in a high degree, and had numerous tuberculous bacilli* in the lungs, spleen, liver and kidneys.

21. *Lung affected by "perlsucht"* partially calcareous knots with quite numerous bacilli, inoculated into eight guinea pigs. These died within five to eight weeks and were all tuberculous in a high degree. From one of these guinea pigs four others and from a second three others were inoculated. Of these animals also five died in the sixth and seventh week, the last two were killed in the eighth week. In all these also tuberculosis was found. Further: From the "perlsucht" lung used in these attempts, a cat was inoculated and died after seven weeks, tuberculous. A second cat inoculated with lung tubercles from this animal after six weeks appeared emaciated and short-breathed. She was killed and found to have numerous tubercles in the lungs and spleen.

22.—A "*perlsucht*" knot from the *peritoneum* inoculated into six guinea

*Lately Demme, Pfeifer and Dontrelepoint have made communications relating to the occurrence of tuberculous bacilli in *lupus-skin* and in the tubercles of animals inoculated with *lupus*. My investigations in regard to *lupus*, which include not only the proof of bacilli in *lupus skin* and in inoculation tubercles, but also long continued "rein-culturen" of *lupus-bacilli* and successful inoculation undertaken with them, had been concluded for several months, when those communications were published, so that these could have had no influence upon my work.

pigs. Three of them died in the fifth and sixth weeks, the others were killed some days later. All tuberculous.

23. *Perlsucht knot from the lung*, partly with caseous contents, and not very rich in bacilli. Seven guinea pigs. Five of them died up to the seventh week. The last two were killed in the eighth week. All tuberculous.

24. *Calcareous perlsucht knot from the peritoneum* with many bacilli. Three guinea pigs; these died up to the sixth week. All tuberculous.

25. *Caseous pneumonia of pig*.—Thickened, very bacilli-rich lung tissue. Five guinea pigs. These died in the fifth and sixth week and were tuberculous.

26. *From the lung tubercles of a rabbit* which died of spontaneous tuberculosis, four guinea pigs were inoculated. Two of these died in the seventh week, two were killed in the eighth week. They were all tuberculous. Four guinea pigs were again inoculated from the first of these animals, two guinea pigs and four rabbits from the second, two rabbits from the third, and one guinea pig and one rabbit from the fourth. The guinea pigs were inoculated subcutaneously, the rabbits in the anterior eye-chamber. The guinea pigs died up to the seventh week of tuberculosis, the rabbits all were attacked with iris-tuberculosis; two died in the ninth and tenth week of tuberculosis, the others were then killed and more or less lung tubercles were found in them.

27. Two guinea pigs and two cats were inoculated with *lung tubercles from a monkey*, which died of spontaneous tuberculosis. The two guinea pigs died in the sixth week, one cat in the seventh, the other after thirteen weeks. All tuberculous. Six guinea pigs and one rabbit (in the anterior eye-chamber), were then inoculated from one of the guinea pigs and these were all found to be tuberculous before the eighth week (partly died, partly killed). Finally from two animals of this second group the tuberculosis was reinoculated into seven other guinea pigs with success. Also from one of the cats four guinea pigs were successfully inoculated. It is still to be mentioned that four guinea pigs were inoculated with the spleen of this monkey, which had been dried fifty-six days and with the lung tubercles of the same, which had lain fifty-seven days in absolute alcohol. These animals for four months showed no change, were then killed and proved themselves free of tuberculosis.

28. *From a second monkey* which died of spontaneous tuberculosis two guinea pigs were inoculated with lung tubercles and died of tuberculosis in the eighth and ninth weeks. Further: from these guinea pigs two guinea pigs and one rabbit were inoculated. As these appeared already diseased in the sixth week, they were killed and found tuberculous. Two guinea pigs were inoculated with lung tubercles of the same monkey which had been dried and preserved three days. These animals were also killed in the sixth week and found tuberculous.

These experiments in inoculation which have just been enumerated were made upon one hundred and seventy-nine guinea pigs, thirty-five rabbits and four cats, and the inoculation had as a consequence tuberculosis in every case without exception. Moreover the presence of tuberculous changes did not confine itself to single knots of a doubtful nature in one or the other organ, but in every single case the tuberculosis could be proved with all the certainty wished, first, by the development of the characteristic symptoms of the disease, such as swelling of the

glands, caseous ulceration of the point of inoculation, emaciation and difficulty of breathing; second, in dissection by the far advanced and very considerable pathological changes proceeding from the point of inoculation into the neighboring lymph glands and into the lungs, spleen and liver. Moreover, under microscopic examination the characteristic tissue elements of the tubercle and the presence of tuberculous bacilli was always proved. The manner in which the inoculation tuberculosis conducted itself in the different animals and in the different organs has already been described in detail.

Other experimenters have had less favorable results from their inoculations with tuberculous substance. On the other hand the regularly favorable results obtained by me will appear less striking when it is considered that I never used material in which tuberculous bacilli could not be proved, and that for my inoculations I always used those species of animals which are especially disposed to tuberculosis. Besides this, the fact that the inoculations were carried out with all possible care and exactness may have contributed not a little to the results. One might consider it an omission that no attempts were made with the inoculation of non-tuberculous substances. Nevertheless it did not appear to me necessary to make such attempts myself, because, during the course of my investigations, inoculation with the most manifold substances containing no tuberculous bacilli were made by the hundred in the same rooms, and moreover on guinea pigs and rabbits, and a tuberculosis traceable to the inoculation was never found. Especially was non-tuberculous material very often put into the anterior eye-chamber and not a single time did tuberculosis of the iris result, while after the inoculation with genuine tuberculous masses it never failed to appear. Besides, the abortive inoculations made with the lung tubercles of the monkey, which tubercles had been dried and preserved in alcohol, described in No. 27, form to a certain extent such attempts, for plainly by the death of the bacilli the tubercles had lost their virulence. The attempt was, therefore, an inoculation with different material.

My attempts, therefore, justify me in the conclusion that only the inoculation with bacilli-bearing substances can cause genuine tuberculosis in the animals used for experiment. A distinction in the effect of inoculation from material coming from tuberculous processes of various kinds, (such as miliary tuberculosis, phthisis, scrofula, fungous diseases of the joints, lupus, perlsucht, and other forms of animal tuberculosis) I have not been able to discover. But also in this regard the various sorts of tuberculosis show a perfectly uniform behavior.

F.—EXPERIMENTS IN INFECTION WITH REIN CULTUREN OF TUBERCULOUS BACILLI.

This second group of infection experiments forms the conclusion of the proof that tuberculosis is an infectious disease and that it is conditioned upon tuberculous bacilli. Up to this time it has been proved that tuberculous bacilli occur in all tuberculous disease processes and exclusively in these. Further, that only tuberculous bacilli-bearing substances have the power of causing tuberculosis. But since in both cases the bacilli were still united with parts of the body, the supposition was justified that besides the bacilli still another material of importance, perhaps even the real infectious material, might be present while the bacilli played

only a secondary part. This question could only be decided by inoculating the bacilli perfectly pure and separate from all parts of the body. If they then also created tuberculosis, they must be the only and indisputable infectious material of tuberculosis. The high importance which belongs to just this part of the investigation demanded that the strictest prudential measures should be taken to exclude all errors. With regard to this, as in the former attempts, for every single experiment several freshly bought animals were used. Besides this special counteracting attempts went along with most of the attempts. The animals of every experiment were in a special cage and were strictly separated from all other tuberculous ones; they were also killed as early as possible to prevent a collision with spontaneous tuberculosis and any objection arising therefrom. Further, as various methods of infection as possible and as various species of animals were used in order to find out the working of the reinculture in this direction. The greatest care was used in the disinfection of all the vessels and instruments used, especially the syringes. The culture serving for infection consisted (as was specially proved almost every time), wholly of tuberculous bacilli. The same were lifted with all caution by means of platinum wires heated until red from the stiffened blood serum, which, as has already been expressly mentioned, can easily be done without tearing off the least bit of the blood serum. It is therefore not too much to claim that in most of the attempts absolutely pure bacilli masses were used to which nothing of the breeding ground on which they grew clung. Moreover, in several attempts sterilized blood serum was injected into the animals, which served for the counteracting attempts without the appearance of a trace of tuberculosis. One can therefore claim with all certainty that when genuine tuberculosis is caused by the infection with a tuberculous bacilli-reinculture, which has been continued through several successive breedings, this is to be ascribed alone to the effect of the tuberculous bacilli.

First experiment: Reinculture of miliary tubercles of the human lung (No. 22 in the former enumeration of the reincultures) cultivated through five successive breedings for fifty-four days, subcutaneously inoculated into four guinea pigs. Two animals in the same cage were not inoculated. In the inoculated animals after fourteen days the inguinal glands swelled, the places of inoculation changed into abscesses and the animals began to grow emaciated. One of them died after thirty-two days, the others were killed on the thirty-fifth day. The inoculated guinea pigs, as well the one which died as the three which were killed, showed tuberculosis of the spleen, liver and lungs to a high degree; the inguinal glands were greatly swollen and caseous, and, moreover, decidedly more so on the inoculated side; the bronchial glands were little swelled. The two uninoculated animals showed no trace of tuberculosis.

Second experiment: Reinculture from the tuberculous lung of a monkey, (No. 11) cultivated ninety-five days in eight successive breedings, inoculated subcutaneously into six guinea pigs. Two animals for counter-experiment remained uninoculated. All the animals were killed after thirty-two days and the six inoculated were found tuberculous to a high degree, the two others healthy.

Third experiment: Reinculture from a perlsucht lung (No. 37) cultivated for seventy-two days through six successive breedings, subcutaneously inoculated into five guinea pigs; one animal remained uninoculated. When the animals

were killed after thirty-four days the inoculated showed themselves tuberculous, the uninoculated healthy.

Fourth experiment: Reincultur from the tuberculous lung of a monkey (No. 11), cultivated 113 days in nine successive breedings, subcutaneously inoculated into two guinea pigs, one German marmot, six white rats, five white mice, four field mice, two hedge hogs, six domestic fowls, four doves, two sparrows, three eels, one goldfish, five frogs, one turtle. Of these animals only the guinea pigs, the marmot and the field mice became noticeably sick. These were killed fifty-three days after the inoculation and all found tuberculous to a high degree. The tuberculosis of the marmot has, according to all appearance, a very great resemblance to that of the guinea pig. The spleen is very much enlarged and has a greyish-red marbled appearance, also the liver appears permeated by large yellowish herds. The tuberculously changed organs of the field mouse also look very characteristic. The inguinal glands are considerably enlarged and caseous, the lungs permeated by numerous grey knots from the size of a poppy-seed to the head of a pin, and liver and spleen permeated very uniformly with many whitish tubercles as large as a grain of millet, so that these latter gained a very dainty sprinkled appearance. All the other animals of this experiment were killed two months later and it appeared in their investigation, that one of the five white mice had some grey knots in the lungs, the others were healthy, as were also the rats and the hedge hog. Of the domestic fowls, three had the large tuberculous knots in the intestines and in the liver characteristic of this species of animals. The rest of the animals were healthy.

Fifth experiment: Reincultur from the closed vomica of a phthisic lung (No. 26), cultivated for twelve months in sixteen successive breedings and subcutaneously inoculated into seventeen guinea pigs, two other animals remaining uninoculated. With these animals observations were made as to the effect of means which have the power of hindering the development of the tuberculous bacilli and they could therefore not be killed. In spite of the fact that partly arsenic, partly carbolic acid had been used to the greatest possible extent, the tuberculosis ran its course just the same as in the former animals, the lymph-glands swelled considerably, emaciation occurred, all the animals died in the fourth to the sixth week and were tuberculous in a high degree. The two uninoculated animals were then killed and found healthy.

Sixth experiment: The following reinculturen, first, from lupus (No. 35) in eight successive breedings continued for five months; second, from a fungous joint (No. 34) in seven successive breedings for four months; third, from a scrofulous gland (No. 29) in seven successive breedings for five months; fourth, from miliary tuberculosis, (No. 22) in twelve successive breedings for nine months; fifth, from the vomica of a phthisic lung (No. 25) in nine successive breedings for six months; sixth, from a perlsucht knot (No. 39) in eleven successive breedings for nine months—were subcutaneously inoculated, and, moreover, from every one of the culturen four animals were inoculated. The mice were put in twos into roomy glasses. Some animals died after a few days, apparently in consequence of the influence of the imprisonment. All the others visibly grew ill, the inguinal glands began to swell, the animals became emaciated and suffered from difficulty of breathing. In the course of four to six weeks they all died. The examination

of some of these animals was utterly prevented or only incompletely possible, because the still living field-mice, in spite of having abundant vegetable food, often gnawed their dead comrades and ate up the inner organs of the same with great ravenousness. Nevertheless, from each single division of this experiment some animals remained for examination, and it could therefore be determined that they all perished from a high degree of tuberculosis of the lungs, liver and spleen. A distinction in the conduct of the tuberculosis proceeding from the various reinculture was not to be recognized. The general appearance of the pathological changes was identical in all animals and so was the appearance of the single little knots to the naked eye, as well as their microscopic conduct and especially their tuberculous bacilli contents. For this experiment it is worthy of notice that the animals had been in imprisonment only a few days when they were inoculated, and that a large number of other field-mice under the same conditions had been kept in glasses for months without a single one of them becoming tuberculous.

Seventh experiment: Since field-mice are such a sure and convenient reagent for tuberculosis, for the purpose of experiments which I made with Dr. Gaffky twenty-four field-mice were subcutaneously inoculated with the reincultur from a phthisic lung (No. 1) cultivated for seven months in twelve successive breedings. These experiments were made in regard to the influence upon tuberculous animals of substances hindering the development. Also from these animals, which were treated with inhalations of easily evaporating substances, some died after a few days of pneumonia, tuberculosis developed itself in all the other, and ran its course in the same way as in the mice of the previous experiment. Under dissection, a well-marked tuberculosis of the lungs, spleen and liver always showed itself.

Eighth experiment: For the same purpose five guinea pigs were inoculated with reincultur from caseous pneumonia (No. 23) cultivated for six months in eight successive breedings; further, four guinea pigs with reincultur from a phthisic lung (No. 24) cultivated for six months in ten successive breedings, and six guinea pigs with reincultur from tuberculosis of the testicles (No. 33) cultivated for three months in five successive breedings—all subcutaneously. These animals had also various gas-like development-hindering substances to breathe in, but in spite of it became sick and emaciated, died within four to six weeks and were under dissection all found tuberculous.

Ninth experiment: Reincultur of lupus (No. 35) cultivated for twelve months in fifteen successive breedings subcutaneously inoculated into five guinea pigs. This experiment was undertaken in order to see whether the continuation of the cultur of tuberculous bacilli from lupus-skin for the space of a whole year had any influence upon the virulence of the same. This was, nevertheless, not the case. The inoculated animals were taken sick just as surely and quickly as in the former experiments; two died in the fourth week, the others were then killed and all found under dissection to be tuberculous in a high degree.

Tenth experiment: With the same intention the longest continued reincultur (No. 1) of human lung phthisis, cultivated for eighteen months in twenty-six successive breedings, was subcutaneously inoculated into four guinea pigs. The course of the disease was just the same as in the ninth experiment. The animals died in the fourth and fifth week of the inoculation and were tuberculous.

Eleventh experiment : By former opportunities an essential difference in the sensitiveness of house mice and field mice to inoculation with tuberculosis had shown itself. Again, therefore, twelve white mice were inoculated with a reincultur of miliary tuberculosis (No. 22), the same which had served in the inoculation of the field-mice in the sixth experiment, and, moreover, at the same time as the field-mice. While the field-mice, as has already been said, became tuberculous, the white mice remained for two months without any appearance whatever of sickness ; they were then killed and tuberculous changes found in none of them.

These eleven experiments have the one common feature, that the inoculating substance was put into the animals subcutaneously. The effect was in general the same as when fresh tuberculous pieces of tissue were inoculated subcutaneously. The little skin wound closed up and healed in the first days, then followed gland swelling, emaciation, death, and dissection showed a great far-reaching tuberculous eruption in lungs, spleen and liver, with the further characteristic changes of these organs belonging thereto. Only in so far a distinction was noticeable as that after inoculation of the reinculturen the course of tuberculosis was a more rapid one, than after the inoculation of tuberculous tissue. For guinea pigs this difference in time can be reckoned on the average as about two weeks. This appearance explains itself most naturally by the assumption that in the inoculation of tuberculous tissue, the tuberculous bacilli are enclosed by the latter and cannot, therefore, have their effect until the tissue is resorbed, while those in the reinculturen can get immediately into the subcutaneous tissue of the animal, and can immediately begin to act. The same is the case in the inoculation of the anterior eye-chamber of rabbits, and the iris-tuberculosis arising from it, and it is here the case to a more striking degree because the development of the tubercles can here be observed with the naked eye. Microscopically the tubercles obtained by the inoculation of reinculturen resemble in every way those obtained by the inoculation of genuine tuberculous tissue, and just the same the tubercles arising spontaneously. They consisted of heaps of cells, which mostly had the character of epithelioid cells and closed giant cells, and contained besides these, tuberculous bacilli in greater or less numbers. Their virulence could be seen from the fact, that in all cases they had spread themselves out from the subcutaneous tissue over all the organs favored by tuberculosis. Besides this, in several cases, farther inoculations were carried out upon other animals and tuberculosis regularly created thereby. The inoculation of the reinculturen remained without effect only in some species of animals, little or not at all sensitive to tuberculosis. On the contrary it made the other numerous animals tuberculous without exception, and as, besides this, all the animals used for counter-experiments remained healthy, there could be no doubt that the question for the decision of which these experiments were undertaken, must be answered in the affirmative, and that the tuberculous bacilli are to be considered the sole cause of tuberculosis.

Nevertheless, it seemed necessary not to stop here, but also to introduce the reinculturen of tuberculous bacilli into animals by all the other methods of infection used up to this time in investigations regarding tuberculosis, in order so to prove in every direction their identity with the tuberculous virus. The methods

used up to this time were the following: Inoculation into the anterior eye-chamber of rabbits, injection into the abdominal cavity, injection into one of the larger veins, inhalation of reincultur of tuberculous bacilli.

INOCLATION OF REINCULTUREN IN THE ANTERIOR EYE-CHAMBER.

A cut several millimeters long was made in the cornea, and, moreover, on the upper border of the same, and by means of a blunt hook as small a crumb as possible of a reincultur was pushed through this into the anterior eye-chamber of a rabbit. Some practice and patience are required for this, and on this account I afterward followed another method. The cultur, rubbed to pieces in distilled water, was taken into a syringe, whose needle must be very fine and sharp. The point can easily be pricked through the cornea into the anterior chamber, and the liquid can then be injected into it. This last method is so far more favorable as that the quantity of the infectious material can be very easily controlled. One sees plainly, in moving the piston of the syringe, how the cloudy injecting fluid mingles with the aqueous humor in the eye chamber, and one can inject much or little liquid as he will. A minimum of bacilli can be brought into the anterior chamber, if the needle of the filled syringe be put into it, and without a real injection be taken out again, since traces of the liquid in the needle mix with the water of the chamber, even if the piston of the syringe be not set in motion.

Twelfth experiment: Little crumbs of a reincultur from a caseous-pneumonic lung (No. 27) cultivated for three months in five successive breedings, were put into the anterior eye-chamber of three rabbits. After a few days an intense iritis developed, the cornea soon became cloudy and yellowish gray. The animals then became emaciated very rapidly. They were killed after twenty-five days, and beside the caseous-purulent destruction of the bulbus, swelling and caseous degeneration of the lymph-glands of the lower jaw and of the base of the ear, very numerous tuberculous knots, partly with whitish centres, were found in the lungs.

Thirteenth experiment: Reincultur from a perlsucht lung (No. 19) cultivated for three months in five successive breedings, was rubbed with sterilized blood serum, and injected into the anterior eye-chamber of two rabbits. A third rabbit received just such an injection of pure blood serum. In the case of the first rabbits the same appearances as in the twelfth experiment occurred. Iritis quickly running its course, and cloudiness of the cornea in a few days. The eyes of the third rabbit showed no change. The animals were killed after twenty-eight days. The rabbit into whose eye the pure blood serum had been injected showed itself perfectly healthy; the other two had caseous bulbi, swollen lymph-glands provided with caseous spots on the lower jaw and beside the base of the ear, and numberless tuberculous knots in the lungs.

Fourteenth experiment: Four rabbits concerned. Pure blood serum was injected into the anterior eye-chamber of the first. The needle of the syringe, which contained blood serum with an addition of reincultur (from tuberculosis of monkey No. 12, cultivated four and one-half months in eight successive breedings) was put into the anterior eye-chamber of the second, but the piston was not moved; several drops of blood serum mixed with reincultur were injected into the anterior eye-chamber of the third and fourth rabbits. In the case of these last two animals

there developed iritis suppuration of the bulbus, followed by rapid emaciation. In the case of the second rabbit, on the contrary, the eye remained unchanged in the beginning and not until the second week did there appear single white yellowish knots on the iris in the neighborhood of the point of injection, and proceeding from this a typical iris tuberculosis developed itself. New little knots constantly appeared on the iris, the iris laid itself into ray-shaped folds, but the cornea gradually became cloudy and thereby hid the other changes from view. The animals were killed after thirty days. The first was perfectly healthy; in the second, aside from the already mentioned changes in the eye, the lymph-glands on the jaw were found swollen and permeated with yellow-white herds, the lungs and other organs were still free from tuberculosis. The two last rabbits had again numberless tubercles in the lungs.

Fifteenth experiment: Reincultur of miliary tubercles from a human lung (No. 4) cultivated for four and one-half months in eight successive breedings, was rubbed up with blood serum and the needle of a syringe filled with it and pricked into the anterior eye chamber of six rabbits without, however, making an injection. In all the animals iris tuberculosis developed, in some of them a slowly spreading infiltration of the conjunctiva with tuberculous knots, reaching beyond the neighborhood of the point of inoculation. Two of the animals of this experiment killed after four weeks had already caseously infiltrated lymph-glands on the neck, but still no tubercles in the lungs. The other rabbits were killed after eight weeks and more or less numerous tubercles were then also found in the lungs.

At various times rabbits received injections of reinculture in the anterior eye chamber in order to test the influence of substances, which hinder the development of tuberculous bacilli in these animals. Of these attempts which, as has already been mentioned, I carried on with Dr. Gaffky, a report will be given on a later occasion. It may be said here in passing, that beside numerous other means, arsenic,* helenin, sulphuric hydrogen, and moreover always in the largest possible doses and for weeks at a time, were used upon the animals. We cannot state a favorable effect of one of these means in a single case. All the animals perished tuberculously just as quickly as those which had not been treated with means hindering development. The infection took place in various ways; partly by simple inoculation (comp. experiments 7 and 8) partly by injection into the eye-chamber, partly by injection into a vein. The rabbits infected from the eye-chamber concern the following cases:

Sixteenth experiment: Reincultur of miliary tubercles of the human lung (No. 22) cultivated for eight months in ten successive breedings, rubbed up with distilled water and injected into the anterior eye chamber of two rabbits; Reincultur from a phthisic lung (No. 1) cultivated for thirteen months in twenty-one successive breedings, injected in the same way into fifteen rabbits. Some of the same reincultur one month later injected into six rabbits. All these rabbits perished

* The use of arsenic to fight tuberculosis has been often recommended in former times and tried by many physicians. It was therefore natural to test the influence of this on tuberculous animals. Our experiments occurred almost a year before the recommendation of arsenic by Buchner appeared, and were, therefore, not induced by that. According to Korab, helenin has prevented tuberculosis and sulphuric hydrogen was warmly recommended by Froschauer.

quickly with the already described symptoms and had always numerous tuberculous knots in the lungs.

In all the cases of these experiments, in which very small quantities of the reincultur were successfully brought into the anterior eye-chamber, the effect was exactly the same as after the implantation of the natural tuberculous virus in the anterior eye-chamber. Single tuberculous knots appeared in the iris, which increased in number and led to caseous degeneration of the bulbus and finally to general tuberculosis. In so far, to be sure, a distinction existed in that the eruption of little knots occurred earlier than after the inoculation with tuberculous tissue. The probable ground of this appearance has already been discussed. A very noteworthy fact has been gained from the experiments, namely, the considerable difference in the effect according as a small number of bacilli or a large quantity of the same get into the eye-chamber. In the first case we see a process slowly creeping on, in which the infectious material first spreads itself upon the iris, then reaches the lymph-glands, makes these caseous and not until then forcing itself into the course of the blood and so becoming sowed over other organs of the body. If, on the contrary, a large number of bacilli are in the beginning deposited in the anterior eye-chamber, then it has an appearance suggesting that the before-mentioned way is unnecessary. Especially it appears as if the lymph-glands, which usually offer an opposition to the progress of the bacilli and hold them fast for a longer or shorter time, were passed over altogether. The appearance of very numerous tuberculous knots in the lungs, spleen, etc., occurs as early in this mode of infection as after the injection of tuberculous bacilli immediately into a vein. Also the quantity of the little knots after the injection into the anterior eye-chamber does not compare very unfavorably with the quantity of them after injection into the course of the blood. Now whether the explanation of this is to be sought therein, that the bacilli of the anterior eye-chamber can really in any way come direct into the course of the blood in quantities, or whether their great number, which suddenly overflows the lymph passages and glands lying before us, causes most of the bacilli to break through the hindrance, so that only a few remain, that I must leave undecided. At all events this appearance is adapted to give enlightenment as to the apparently inexplicable irregular conduct of tuberculosis with reference to the duration of its course and to the longer or shorter local confinement.

INJECTION OF REINCULTUREN INTO THE ABDOMINAL CAVITY.

The reinculturen, rubbed up with blood serum or distilled water, were filled into a disinfected syringe, the point of operation on the abdomen of the animal was disinfected with sublimate solution, and then the needle slowly driven through the covering of the abdomen so that the intestines remained unhurt, and then the liquid was squirted into the abdominal cavity. This of itself very simple operation can easily be performed upon animals whose intestines are not constantly filled with firm, unyielding matter, and I have always succeeded with guinea pigs, rats, mice, cats, etc., without causing injury to the intestines or traumatic peritonitis. Rabbits are less adapted for this experiment on account of the closely filled cœcum. In order to obtain as quick an effect as possible, considerable masses of reincultur were always injected. The abdominal cavity, like the eye-chamber,

reacts differently according to the different quantities of tuberculous virus. After an injection of pus containing few bacilli there arose on the peritoneum, as we have already seen, a disseminated tuberculous eruption, then a development of little knots in the omentum and the spleen. But when masses of tuberculous bacilli were injected into the abdominal cavity of guinea pigs, then they were principally taken up by the large omentum. This rolls itself together and forms a horizontally-extending, thick, sausage-like roll, which on intersection has the greatest resemblance to an intersected, greatly swollen, and freshly caseous lymph-gland. In these white-yellowish, quite compact herds of the omentum enormous quantities of tuberculous bacilli are found, most of which are in a fine state of spore formation. Besides this, as microscopic investigation shows us, the swollen spleen, the liver and the peritoneum are abundantly supplied with tuberculous bacilli, but the death of these animals occurs so early that the development of knots visible to the naked eye has not had time to occur. An effusion of liquid was not found in the abdominal cavity of guinea pigs, but was found in dogs and cats. On the contrary, in guinea pigs, such a large quantity of clear, faintly yellow liquid was found in the pleura that the lungs were compressed by it, and this caused the death of the animal. The guinea pigs usually died ten to twenty days after the injection. If a smaller quantity of cultur substance is squirted in, the course of the disease is of longer duration and there is then a development of visible, extraordinarily numerous tuberculous knots, particularly upon the peritoneum, on omentum, in the spleen and liver. The species of animals less subject to tuberculosis—dogs, rats, white mice—do not succumb even to the injection of abundant bacilli until after some months. But they then show also an unusually abundant tuberculous eruption in the abdominal organs, but, on the contrary, less numerous knots in the lungs.

Seventeenth Experiment : Reincultur from the tuberculous lung of a monkey (No. 11) cultivated for six months in eleven successive breedings, was rubbed up with blood serum and injected into ten guinea pigs, a half cubic centimeter into each. Two animals for counter experiment received, the one just such an injection of pure blood serum, the other, which had a fresh, large wound from a bite, no injection at all. Of the animals which had received the injection, deaths occurred after ten, thirteen, sixteen, seventeen, eighteen days. The others, as well as the "controlhiere*" were killed on the twenty-fifth day. In the guinea pig which died first the large omentum was rolled together, greatly thickened, and infiltrated with a yellowish-white brittle substance; no knots were visible on the liver and spleen. The other animals of this experiment, as well those which died as those which were killed, had, besides infiltration of the omentum, already tuberculous eruption of the spleen and liver. The controlhiere were perfectly healthy.

Eighteenth Experiment : Reincultur of the tuberculous lung of a monkey (No. 11) cultivated for five and one-half months in ten successive breedings, rubbed up with blood serum, was injected into the abdominal cavity of two full grown vigorous cats. The one cat died after nineteen days. The omentum was rolled together, very much thickened, and infiltrated with a whitish compact mass. The serous covering of the intestines and the peritoneum had lost its lustre, the

* Animals for counter experiment.

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spleen was greatly enlarged.* The infiltration of the omentum consisted, as in the guinea pigs of the previous experiment, of thick masses of tuberculous bacilli, embedded mostly in cells. With the naked eye no knots could be seen in the lungs, spleen and liver, but microscopically these organs were permeated already by an unusually abundant tuberculous eruption. The second cat was killed after forty-three days, and there were already tuberculous knots as large as a millet seed in great numbers, quite uniformly spread over the lungs, spleen and omentum, while in the liver the number was comparatively small. Both cats were to have received a syringe-full of the injecting liquid, therefore an equal quantity, but the second was very uneasy during the operation and only a small part of the liquid could be successfully injected; on which account the tuberculosis had a considerably longer course, and fewer tuberculous knots developed which had time to reach a considerable size.

Nineteenth Experiment: Reincultur of miliary tuberculosis (No. 22) cultivated for three months in five successive breedings, rubbed up with blood serum, and two cubic centimeters of this liquid injected into the abdominal cavity of a female dog several years old. A half cubic centimeter of the same liquid was injected into a male dog some months old. In the first weeks after the injection no change could be seen in the animals. After the third week the female dog lost her briskness, she ate less, and a noticeable swelling of the body occurred. This animal was killed at the beginning of the fifth week. In the abdominal cavity was a quite abundant effusion of a clear, faintly yellowish liquid. The omentum, mesenterium, ligaments of the womb and peritoneum were sprinkled over with many tuberculous knots, as were also the surface of the intestines and bladder. The enlarged spleen, the liver and lungs contained numerous miliary tubercles provided with tuberculous bacilli. The places of injection could no longer be recognized. The second dog appeared sick for a time, had also plainly an effusion of liquid in the abdominal cavity, and became emaciated; finally it recovered and developed very vigorously. This dog, together with a female from the same litter, received five months later an injection from the same reincultur, this time however of two cubic centimeters. The result was the same in both animals: for some weeks they showed no symptoms of disease, then became emaciated and were attacked by ascites. One animal died after five weeks, and then the other, which was already very weak, was killed. The information gained from the dissection was exactly the same as in the case of the first dog. Omentum, peritoneum, spleen, liver and lungs were supplied with extraordinarily many tuberculous knots.

This experiment is in so far of special interest as that one dog after the injection of a half cubic centimeter of bacilli liquid was, to be sure, taken sick, but recovered. This is the only case of tuberculosis in animals which I have seen recover. The hope has often been expressed that, as in the case of inflammation of the spleen, a preventive inoculation with weakened virus might be used against tuberculosis. But if one recovery from tuberculosis gives protection against a second attack of the disease, for which, by the way, experience by the sick bed gives no ground of hope, then this dog should have had immunity against further experiments in infection. But this was not the case, and this circumstance speaks against the justification of such hopes.

(To be continued.)

REPORTS OF CASES.

"Careful observation makes a skillful practitioner, but his skill dies with him. By recording his observations he adds to the knowledge of his profession, and assists by his facts in building up the solid edifice of pathological science."—VETERINARY RECORD.

AMERICAN VETERINARY COLLEGE, HOSPITAL DEPARTMENT.

Cases by J. HÜLME, D.V.S. and R. MORRISON, D.V.S.

FISTULA COLLI.

A CONTRIBUTION TO THE HISTORY OF SIMILAR LESIONS AND SUGGESTIONS AS TO THEIR CORRECT PROGNOSIS.

Fistulous tracts situated in any portion of the body between the head and the withers, are always serious in their nature, and rarely yield satisfactorily to treatment, and perhaps, of all this class of cases, none are more troublesome than those which occur on any part of the superior cervical region, on account probably of the difficulty of fixing upon a positive diagnosis as to their cause. The following case may prove of interest, and perhaps afford some useful data in the history of similar lesions.

This patient, a government animal, was a good looking bay horse of six years. Some two months previously, a small swelling appeared on the off side of the neck, which was opened, and had been discharging ever since. Caustics of various kinds and under various forms, both liquid and solid, had been used, but without benefit, and he was sent to the hospital, where the wound was carefully examined. It was found to be about two inches long, situated about the middle of the right side of the neck, somewhat below the superior border, and connecting with a tract extending downwards, backwards and inwards, which discharged a quite abundant suppuration, laudable in character, but perhaps a little thin.

On account of the directions of the tract it was decided to make a counter opening, and for that purpose the S probe was introduced and found to pass with but little difficulty from the right to the left side of the neck. A seton was then introduced into the new-made tract, and both openings being

enlarged to allow free escape of pus, the animal was treated by merely washing the discharge twice daily and injecting carbolic solution through the fistula.

This simple treatment was followed during eight days consecutively, with the result of apparent or (perhaps fancied) alternating or fluctuating improvements, followed by a return to the condition of *statu quo*.

The wounds showing a tendency to close, they were then enlarged on both sides, and a fine tubing or hydrant was introduced through the higher one, (that of the right side), and the tract more thoroughly washed, the exit of the water carrying with it in its course, not only pus, but sloughs of diseased tissues. This treatment having been continued for a few days, it was noticed that the neck seemed to become swollen, and the enlargement seemed to involve that entire region of the body. It was not painful to the touch, but seemed merely to render the movement of the animal difficult. This swelling was at first scarcely perceptible, but continued to increase for four days from that of its appearance until it had become quite serious, and being attributed to the infiltration of water during the washing of the tract with the hydrant, this was discontinued, and only the external washing persevered with.

For several days following, the degree of swelling seemed to remain unchanged, but from that time it maintained a downward movement towards the lower border of the neck, diminishing in proportion towards the superior, and then passing to the fore part of the chest, down to the fore legs, when, by degrees, it disappeared.

No change, however, had taken place in the fistula in the neck. There were the same appearances with the same alternating diminution and increase in the amount of the discharge, notwithstanding the modification of treatment, with new setons, caustics, injections, antiseptic washes, etc.

Then, one morning, on dressing the patient, it was observed that on pressing from below upwards, on the right side, the discharge of pus became more abundant, and still more so if the pressure was made on both sides together, and

in the same manner from below upwards, or from behind forwards.

Evidently there was a cavity, a *cul de sac* opening in the fistula, and where at the same time the pus accumulated, but what its depth, situation and capacity might be remained still to be ascertained by further experiment. Accordingly, the opening on the right side was enlarged freely, and the pus being detected oozing between the muscles, a free and deep incision was made, which uncovered a cavity, from which pus and diseased ligamentum nuchæ were washed out. The wound measured about eight inches in length and reached down half the thickness of the neck.

It was now hoped that the bottom of the difficulty had been reached, and strong expectations of effecting a cure were entertained, when official orders were received for the destruction of the patient, which, of course, were executed.

At the post mortem, which could not be made as thorough as was desirable, it was found that even with that deep incision and a free use of the bistoury, the bottom of the trouble had not been reached, as several fistulous tracks were detected, one amongst them being larger than the others, and running all the way down along the ligament nuchæ which was diseased between that and the complexus major muscle until it reached the base of the neck, near the dorsal region, a condition which most undoubtedly would have proved rebellious to any form of treatment.

PROLAPSUS UTERI IN A BITCH.—AMPUTATION.

The patient, a handsome large mastiff bitch, about twelve months old, had been placed in a stable, to be lined by another of her breed. Both dogs were tied up, but were too far apart to allow of contact. The following morning the bitch was found with prolapsus uteri, and was the same afternoon sent to the hospital. Indeed, when she was admitted she showed her vulva dilated by a round, red, fleshy swelling, protruding somewhat outwards. Slight pressure returned the organ to its place. The labia of the vulva were kept together by two sutures, and bandages were applied, but these being bitten off, the uterus soon returned to its abnormal

position. The dog was otherwise perfectly healthy, being playful and kind, and allowing handling without trouble, and her appetite was good and all the functions normal.

The second day after her admission the uterus was pushed in thoroughly and replaced in its normal position, and the vulva closed by pin sutures supported by bandages. During the day, however, one of the sutures slipped off, and the prolapsus again returned. Another closure of the vulva was followed by no better results, the organ pushing its way out, notwithstanding the external application of bandages and the use of ice introduced into the vagina.

Having failed to make any progress in the treatment, an attempt was made to keep the organ in place by pushing into the vagina, after effecting the reduction of the uterus, a child's toy balloon, which when inserted was inflated from without, but this failed with the rest.

The amputation of the organ was then decided upon. After carefully washing and cleansing it, together with the surrounding tissues, with a weak solution of bi-chloride of mercury, a strong carbolized catgut ligature was applied around the tumor represented by the everted organ, close to the base, and tied firmly, being secured by triple knots. The portion of the organ projecting back of the ligature was then amputated, and the catgut cord cut as short as possible, but left long enough to be seen and secured, if necessary, by the dilatation of the vulva.

It was found the next day that the animal had pulled out the ligature, and that a slight hemorrhage had taken place, but had stopped spontaneously. On the third day following, a small portion of tissue sloughed away. The parts were kept antiseptically clean, and on the seventh day the animal was discharged in a condition of full convalescence.

A PECULIAR CASE DUE TO A FOREIGN BODY IN THE STOMACH OF A DOG.

The dog, a cocker-spaniel, was admitted to the hospital with the following history: He had been taken sick some days before, with constant vomiting, refusing to keep any-

thing on his stomach, and having been shown to a veterinarian, was treated for gastro-enteritis. Having somewhat recovered from this trouble, he was found one morning suffering with prolapsus recti, for which almost all forms of external treatment were employed, such as pads, sutures, pessaries, etc., accompanied by the internal administration of strychnia. When he was admitted, the little fellow was very uneasy, and carried with him a pessary, which was removed, proving to be made of a smooth block of wood, about three-quarters of an inch in diameter and some three inches long. The parts being carefully washed out, and antiseptics locally applied, the prolapsus having remained in its natural position, the dog was placed in a kennel and watched. On the following day the same state of things existed, the patient having strained somewhat, but sedatives soon quieted him. He drank a little milk, seemed more lively, took notice of people around him, and showed no evidence of pain. On the third day, the dog had two regular fits, after which he strained quite violently, and had another small prolapsus, which was reduced. The animal was placed and kept under opiates. He refused all kinds of food. The fourth day showed no great change; there was another slight fit, treated as before. He still refused all food. On the fifth day he was found dead in its kennel.

At the post mortem, the following lesions were found: the stomach was enlarged and congested, and contained a large ball of brown paper tightly rolled and partly pushed into the pyloric opening of the stomach. The intestines were empty, containing only some mucus and bile. The rectum was slightly congested at the places where the pessary had rested against it. Both cavities of the heart contained large clots, the balance of the organism was healthy.

EPILEPTIC FITS DUE TO STOMACHAL OVER-LOADING AND INTESTINAL OBSTRUCTION.

The subject of this case was a sky terrier about six months old, which had always enjoyed good health, and was brought to the hospital on the 15th of May, with the history that he

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had been in convulsions for the last twenty-four hours. The patient would occasionally get up and begin to walk, but would soon turn in a circle of short diameter for a little while, then falling down again in a fit and frothing at the mouth. No information could be obtained as to the cause of the trouble. A dose of bromide of potass. was given, but seemed to give no result, and the animal died about two hours after admission. The post mortem revealed the cause of all the trouble, in the condition of the stomach, which was enormously distended with gas and food, liquid and solid. On opening the organ, its contents were found to be several large pieces of meat, which resembled liver, and one of them larger than the other, was lodged and firmly imbedded in the pyloric opening of the stomach. All the other organs were healthy.

MAL-ADDRESS.

By S. R. HOWARD, V.S., Hillsboro, Ohio.

I enclose a history of a case interesting to myself, and perhaps it may prove of interest to others:

On the 24th of May I was called to see a seven year old mare. Owner informed me that on 14th she was served by a vigorous grade stallion. On way home she laid down and appeared colicky, and straining, passed a small amount of fœces, and with it about a pint of blood. Shortly appeared better and arrived home all right.

From that time—the 14th—until I was called—the 21st—she had no passage of fœces. During all this time she remained uneasy, straining more or less constantly, small amount of bloody pus dribbling from anus, occasionally tympanic, yet strange to say, appetite had remained unimpaired. Owner did not know positively how animal had been served.

On 21st I found temperature 105° F., pulse 50, yet strong, anus and vulva tumefied, great borygmus, dull appearance and occasionally lying down. Found rupture at termination of colon, right side large enough to pass fist easily into cavity. Rectum full of bloody fœtid pus.

Advised destruction. Gave warm antiseptic injections

with opium and hyposulphite of soda internally. Removed what fœces I could reach. Could find none in abdominal or pelvic cavity. This last I consider strange.

Passing on 27th, saw them about to bury her. Just died. Had had two small passages shortly before death. At post mortem all the intestines appeared inflamed. Bladder empty and pelvic cavity jammed full of fœces. Large amount of reddish water in abdominal cavity. Rupture of termination of floating colon almost complete; a frightful looking rent. Lived sixteen days.

EXTRACTS FROM FOREIGN JOURNALS.

INVAGINATED SEQUESTRUM OF THE SCAPULA IN A HORSE.

By MESSRS. BARRIER AND GERVAIS.

The subject of this report is an uncommon lesion, resulting from a kick received on the anterior border of the scapula, a short distance above the scapulo-humeral joint. The injury was not apparently of a serious character, the cutaneous wound being very small and the lameness but trifling, and nothing appearing to cause any suspicion that the matter was anything beyond a slight ordinary hurt. But notwithstanding the treatment which was suggested by the apparent condition of the case, the animal, a few days later, became very lame and the shoulder badly swollen, with a discharge from the wound of a reddish, bloody and suppurative matter, which escaped from a fistulous tract, which, on being probed, proved to extend but a very short distance down to the antea spinatus muscle. There was nothing to indicate a diseased condition of the scapula, and yet the excessive pain, the hard and warm swelling of the region, and the aspect and nature of the fistulous wound all pointed to the suggestion of a fracture of this flat bone.

The animal was consequently placed in slings, and an application of blister and mercurial ointment applied over the whole affected region, notwithstanding which he grew worse, and constitutional disturbances soon manifested themselves. He lost his appetite, and refused to rest on the slings, and in

consideration of these serious symptoms, was ultimately destroyed.

On removing the leg from the trunk, at the post mortem, numerous purulent collections were found in the axilla, the shoulder being surrounded by a large, hard, grayish colored swelling on both surfaces. All the external scapular muscles were involved in it, and had lost their coloration, becoming pale and containing numerous small purulent centres; the sub-scapularis muscle on the inside presenting the same appearance. On maceration, the scapula appeared to be surrounded by an osteo-cartilaginous muff, and constituted a true sequestrum, entirely surrounded or *invaginated* by the newly deposited bone on its outer surface.

According to the authors, the following should be the general process followed in the formation of this pathological specimen:

1st. A traumatism of medium severity, received on the anterior border of the scapula, penetrating the enveloping skin and muscles.

2d. An insignificant wound of the skin.

3d. Suppurative ostitis, consequent upon the traumatism, forming on the bone, at the injured or contused spot, with separation of the periosteum and formation of an areolar tissue of new formation.

4th. The increase and extension of the suppurative osteitis, which, instead of remaining limited, gradually enlarges and spreads until the scapula becomes isolated and surrounded with a new layer of bony tissue.

5th. The scapula becomes necrosed and forms the sequestrum, in consequence of its deprivation of the blood necessary to its nutrition.

6th. The purulent collection in the muscles and new surrounding structure was the consequent result of the excess of the inflammation, which in a reduced degree might have been followed by a comparative recovery.—*Recueil de Med. Vet.*

A NOTE OF SUGGESTION IN RELATION TO THE DIAGNOSIS OF BOVINE TUBERCULOSIS.**By MR. G. BOUCHET.**

A cow taken with tympanitis, from which she was very sick, was relieved by puncture of the rumen, and upon inquiring into her history it was learned that she had always been in condition, and good health, though she had had a deep, thick and repeated cough, to which, however, no importance was attached. She continued healthy for a year, and had a calf, which she raised well, and had been well up to the time of the author's visit. Careful examination failed to detect any indication of the cause of the trouble. At the autopsy made at a later period, a mild abdominal tuberculosis was detected, involving more or less the entire abdominal structures. In the chest, the pleura was found normal, as also were the lungs, with the exception of a few tuberculous products through their thickness. The tuberculous process was principally located in the glands of the posterior mediastinum, all of which were diseased, some of them attaining the size of the fist, and appearing like a mass, surrounded by a capsule. They were of a yellowish appearance, with more or less thick pus in the center. One of the largest of them was situated between the lungs, just under the œsophagus, which it surrounded and more or less compressed, constituting a condition sufficient to explain the resistance to all forms of treatment so often encountered in dealing with tympanitic patients.—*Receuil de Med. Vet.*

PELVIC ABSCESS AS A SEQUELÆ OF DISTEMPER.**By MR. LARDET.**

In this report the author says, "When this complication takes place, which is generally when the animal is in full convalescence, he becomes suddenly dull and loses his appetite, and suffers with attacks of intermittent colic, and after a few days defecation becomes difficult and painful, the fæces being small, hard and coated. Rectal inspection then reveals a tumefied condition of the mucous membrane of that region,

which is more or less smooth, and by careful examination, fluctuation may be detected on the upper wall of the rectal sac. Puncture of the abscess gives exit to laudable suppuration, coming from an abscess of the pelvi-rectal cellular tissue. Such a case seldom ends fatally. A careful examination of the pelvic cavity is always indicated in cases of abdominal and colicky complications, in distemper or strangles, before a correct diagnosis can be made.—*Rec. de Med. Vet.*

ABDOMINAL TUBERCULOSIS IN A CAT.

By MR. NOCARD.

Cases of tuberculosis in the dog or the cat are so uncommon that any new case is deserving of record. The present is the case of a seven-months-old kitten, which for two or three weeks had been losing condition, eating but little, continually lying down, and ultimately attacked with profuse diarrhœa. It was killed, and all the mesenteric glands were found to be hypertrophied, some of them softened and caseous, and the spleen gorged with small miliary tumors, hard and of a greyish color. The intestine was normal, except at the beginning of the cœcum, where the mucous membrane was thickened and ulcerated. The liver, lungs and bronchial glands were healthy. The matter of all the glands and the splenic tumors were, by Ehrlich's method, found full of the bacilli of Koch. The kitten had become infected through the medium of two patients kept in the hospital where he stayed, the patients being themselves sufferers from tuberculosis, and it is supposed that he became affected by eating the remains of the meals left by these tuberculous patients.—*Rec. de Med. Vet.*

WOUND OF THE CAROTID ARTERY.

By MR. VAN AUTGARDEN.

This is a rare form of injury in veterinary records, especially in our days, when phlebotomy is so seldom practised. A horse which had just been bled at the jugular showed a tumor in the jugular groove, which filled it up and interfered

with respiration to such an extent as to give rise to roaring. When seen, the nostrils were widely dilated, the neck stretched, the eyes staring, and the roaring so loud that all the appearances seemed to indicate suffocation within a short time. All the appearances, and the history as well as the symptoms, indicated a wound of the carotid. Trachæotomy was performed immediately, in order to give relief to the difficulty of breathing, though not without trouble, arising from the large escape of blood, which flowed profusely. A large quantity of extravasated blood was washed away, and it soon became evident that the wound of the artery had been closed by a clot, and that no further interference was necessary. The animal made a rapid recovery and resumed work in about ten days. The principal interest of the case rests on the fact that the accident is quite a rare one.—*Annales de Belgique*.

VOMITING IN A HORSE.

BY M. VANDENABELLE.

The animal had refused his supper the day before he was seen by Mr. Vandenabelle, and his manger contained a certain quantity of food, both solid and liquid, which he had vomited at various times. He also had slight colicky pains, but no serious symptoms were exhibited. The rejected masses had a strong acid reaction. While this history and these symptoms were being observed the patient was taken with a peculiar vermicular motion of the œsophagus, easily observed in the jugular groove, and a certain motion of the head, followed by the rejection of a certain quantity of vomited substances. The pulse was small, the mucous membranes normal in color, the eyes anxious and the expression indicative of deep internal pain. Auscultation and percussion gave negative results. Deglutition of liquids was normal.

A doubtful diagnosis was made. In the treatment resort was had to anti-spasmodics in small repeated doses—camphor, valerian and opium, with mustard poultices under the chest, and small quantities of drinks to allay the thirst. No improvement was visible on the next day, and a renewal of

the sinapism and continuation of the same treatment was directed, This was followed by improvement, and recovery on the third day, when all the symptoms had subsided.—*Ibid.*

ŒSOPHAGOTOMY IN THE DOG.

BY PROF. F. HENDRIOK.

After two days of suffering from the presence of pieces of bone in the œsophagus, the author successfully removed them and carried his patients to a complete recovery. In both cases the presence of the foreign substances had been well established, and failing to displace them by probe or repous-sair, the operation had been performed with all the usual anti-septic measures. The mucous membrane of the œsophagus and some of the surrounding parts had undergone a certain amount of gangrenous degeneration which rendered the chances of recovery doubtful, but by a free use of phenic washes and careful attention to the diet, which was strictly liquid for several days afterwards, both patients recovered rapidly, and without any of the complications which had been anticipated when the operation was first contemplated.—*Ibid.*

COLLEGE COMMENCEMENTS.

ONTARIO VETERINARY COLLEGE.

The commencement exercises of this college took place in the last week of March.

The students assembled in Richmond Hall for the closing exercises. The chair was occupied by Professor Smith, and among those with him on the platform were Sir Daniel Wilson; Hon. Charles Drury, Minister of Agriculture; Mr. J. J. Withrow, President of the Industrial Association; Dr. Thorburn, Dr. Caven, Mr. H. Wade, Mr. G. B. Smith, M.P.P., Alds. Frankland and Dodds; also the following members of the Examining Board: Mr. Sweetapple, Oshawa; Mr. Colman, Ottawa; Mr. Lloyd, Newmarket; Mr. Wilson, London; Mr. O'Neill, London; Mr. Shaw, Dayton, Ohio; and Mr. Cowan, Galt.

The principal said that the present session had been one of the most successful in the history of the college. There had been a large attendance of students from all parts of the Dominion, as also from nearly every State in the Union, and one from no less distant a country than the Sandwich Islands. Although a few failed in taking their diplomas, he hoped they would not be despondent, but stimulated to greater exertion. There had been a class of about four hundred during the session, and those from across the line, he knew, had been delighted with Toronto, and had admired its educational institutions generally. Dr. Duncan afterwards read over the list of graduates and the prize and honor list.

Hon. Charles Drury presented the medal of the Agriculture and Arts Association to the winner—Mr. A. E. Sturge, of London, England,—and alluded to the progress of Canada from an agricultural point of view, and to the immense amount of money invested in live stock, which amounted in cattle alone to about \$100,000,000, which pointed to the fact that Canada was fast becoming one of the most important cattle-raising countries in the world.

Among the other speakers were Mr. J. J. Withrow, who presented the gold medal given by the Industrial Association to Mr. F. J. Gallanough, of Thornhill, and referred to the friendly feeling which had existed throughout the term between the American and Canadian students of the college. Dr. Thorburn, Alds. Frankland and Dodds also made short addresses.

GRADUATES.

Adams, Herbert Turgeant.....	Clarksville, Howard County, N. W. T.
Alexander, Thomas J.....	Strathroy, Ont.
Alton, William Wellesley.....	Appleby, Ont.
Alverson, Alfred G.....	Cherry Valley, Ill.
Bowman, Robert C.....	Ilderton, Ont.
Bingham, James Edgar.....	Tyrone, Ont.
Bullivant, James.....	Tempa, Florida.
Bock, Aaron R.....	New Duudee, Ont.
Barnett, Frank E.....	West Salem, Wayne County, Ohio.
Brown, Leopold Alexander	Dunboyne, Ont.
Baker, Lewis R.....	Wannakee, Wis.
Bechtel, Milton T.....	Waterloo, Ont.

Burgess, Herbert W.....	Bennington, Vt.
Boucher, William Woods.....	South March, Ont.
Butler, W. J.....	Stirling, Ont.
Brindle, D. C.....	Chambersburg, Pa.
Beattie, Francis Scott.....	Seaforth, Ont.
Blanchard, William Hutchinson.....	Pocklington, England.
Buckham, James.....	Brampton, Ont.
Blackinton, Joseph C.....	Bate, Ohio.
Campbell, Andrew.....	
Cassels, William G.....	Paisley, Ont.
Campbell, John R.....	Milton, Ont.
Campbell, Peter M.....	Strathroy, Ont.
Church, Joseph Alexander.....	
Callander, J. C.....	Smith's Falls, Ont.
Craig, William B.....	Indianapolis, Ind.
Donaldson, Thomas Alexander.....	
Doan, Berkley Potts.....	Port Dover, Ont.
Duncan, James Edward.....	Canandaigua, N. Y.
Dunn, William H.....	Riga, N. Y.
Dorney, Albert H.....	Allentown, Pa.
Dewey, David D.....	North Manlius, N. Y.
Duncombe, Orlando Hardy.....	Waterford, Ont.
Detwiler, Charles H.....	Iron Bridge, Montgomery County, Pa.
Doswell, A.....	Toronto, Ont.
Diggs, Edward F.....	Winchester, Ind.
Eaid, Charles E.....	Jarvis, Ont.
Eisenhart, Oscar C.....	Bingen, Penn.
Fisher, George Edward.....	Goderich, Ont.
Falconer, Charles.....	Kendall, N. Y.
Franks, J. W.....	
Glendinning, C. G.....	Belfountain, Ont.
Gilchrist, William P.....	Fort Edward, N. Y.
Grieve, John.....	Seaforth, Ont.
Gordon, D. Baillie.....	Ottawa, Ont.
Gallanough, Fred. J.....	Thornhill, Ont.
Greenwood, John.....	Wellesley, Ont.
Hutton, Frederick G.....	Welland, Ont.
Hopkins, Frank M.....	Topeka, Kan.
Hodges, Alfred M.....	Nanticoke, Ont.
Holbrook, John A.....	Townshend, Vermont.
Henry, Elias Wetmore.....	Frederickton, N.B.
Harrington, John Beverley.....	Port Arthur, Ont.
Hill, Joseph G.....	Sennett, N. Y.
Hamilton, William.....	St. Mary's, Ont.
Hougendobler, J. J.....	Rohrerstown, Pa.
Higbee, William F.....	Youngstown, N. Y.
Howard, Samuel Rogers.....	Circleville, Ohio.

Ide, Almon H.....	East Shelby, N. Y.
Jenkins, Henry H., N.W.M. Police.....	Northwest Ter.
Jameson, John W.....	Paris, Ky.
Johnston, William J.....	Minesing, Ont.
King, Thomas.....	Bluevale, Ont.
Kuhn, John Miller.....	Mercersburg, Pa.
Kurtz, Alfred.....	Neenah, Wis.
Leach, Maurice Mackenzie.....	Paris, Ont.
Lloyd, Arthur C.	Detroit, Mich.
Leslie, Henry Charles.....	Canton, Ont.
Mossom, Dundas H. E. McQ.....	London, Eng.
Mullin, D. V.....	Montreal, Que.
Monserrat, W. T.....	Honolulu, Sandwich Islands.
Marshall, Joseph W.....	Forest, Ont.
Manchester, John William ..	Sussex Vale, N. B.
Morrison, William McLeod.....	Birtle, Man.
Murray, Henry B.....	Port Albert, Ont.
McIntosh, Archibald J.....	Toronto, Ont.
McMurtry, D. Henry.....	South March, Ont.
McGregor, Charles F. Mortimere.....	Constance, Ont.
McQuate, Theodore C.....	Canton, Ohio.
McDonald, John.....	Petrolea, Ont.
McGahey, Robert P.....	Kemptville, Ont.
McMicken, William Bell.....	Chesterfield, Ont.
McBeath, Alonzo E.....	Bradford, Ont.
McMurty, W. Randolph.....	South March, Ont.
McCray, W. E.....	Oil City, Pa.
Nighbert, James D.....	Palmyra, Ill.
Old, William R. J.....	Goderich, Ont.
Orr, C. H.....	Cairo, Mich.
Pickering, William H.....	Forest, Ont.
Paul, Bert E.....	Wayland, Mich.
Poe, John Julius Evans.....	Harley Park, Callow, Ireland.
Purcell, Charles Wilson.....	East Boston, Mass.
Petrie, William.....	Watertown, N. Y.
Quantz, Jacob D.....	Bellantrae, Ont.
Rich, Frank Abiram.....	Avon, N. Y.
Rishel, Edward Ira.....	Vicksburg, Kalamazoo County, Mich.
Rose, D. W.....	Toronto, Ont.
Robertson, Gilbert James.....	Beatrice, Neb.
Rike, Harry W.....	Dayton, Ohio.
Spicer, Charles A.....	Pittsburgh, Pa.
Simons, Frank W.....	Marengo, Ohio.
Smith, Charles H.....	Ansonia, Conn.
Sturge, Edgar.....	Guelph, Ont.
Smith, Henry Stephen.....	Albion, Mich.
Shevalier, Eugene D.....	Cortlandt, N. Y.

Swingley, Jacob G.....	Oregon, Ill.
Stevenson, William S.....	Tyre, N. Y.
Sutterby, Joseph.....	Batavia, N. Y.
Stutzman, Benjamin F.....	Chappel, Neb.
Storey, Jonn T.....	Goodwood, Ont.
Spensley, F. T.....	Granger, Ohio.
Saylor, David S.....	Wellington, Ont.
Sherrick, Harry R.....	
Tully, John Walter.....	Chesley, Ont.
Tanner, Byron L.....	Mount Forest, Ont.
Tanner, Vassar E.....	Mount Forest, Ont.
Thwaites, Percy.....	Toronto, Ont.
Warwick, John D.....	Wingham, Ont.
Wiley, Horace H.....	Rochester, Mich.
Williams, Fred Erwaat.....	Burdette, N. Y.
Willson, Purvis O.....	Drumbo, Ont.
Waller, Harry Noel.....	Prairie Club, Semars, Iowa.
Ward, James R.....	Alton, Ont.
Willson, John.....	Leamington, Ont.

A pleasant feature in the proceedings was the presentation of a large picture of the graduates in group form, with the recipients' photograph and those of the following professors in large size underneath: J. Thorburn, M.R.; J. T. Duncan, M.D., H.A.R.C.V.S.; J. Caven, M.D.; G. Peters, M.D.; A. H. King, V.S.; C. Richardson, M.A., to Professor Smith. The picture, which is about six feet square, with gilt bronze frame, contained the likeness of one hundred and seventy graduates. Mr. Montserrat made the presentation, hoping the recipient might long be spared to preside over the institution. Professor Smith suitably replied.

CHICAGO VETERINARY COLLEGE.

The Chicago Veterinary College held its sixth annual commencement exercises in Kimball Hall on Thursday, March 21st.

The hall was crowded with a select audience. Among those on the platform were the Rev. Dr. Utter, Professors Withers, Baker, Hughes, Billings, Reading, Ellingwood, Ryan, Casewell and Periam; Dr. De Wolff, Health Department, and others.

After prayer was offered, President Withers reviewed the

progress made by the institution since its inception in 1883, when the school was started in a small down-town room with eight students attending.

This year the number of attending students was one hundred and five. The present commodious building was erected in 1886, at a cost of \$20,000, but owing to the great increase in the class it will be necessary to add two more complete stories to the structure during the coming summer. When these additions are made the Chicago Veterinary College will be one of the most substantial and complete of its kind.

The President then called the students individually before the platform and presented each with a diploma qualifying him as a doctor of veterinary science.

The following is a list of graduates:

Clarke, Lowell.....	Benton Harbor, Mich.
Cale, H. B.....	McComb, Ill.
Miner, M. L.....	St. Johnsbury, Vt.
Brougham, J. J.....	Chicago, Ill.
Rudberg, Albert.....	Denver, Col.
Daugherty, W. A.....	Avondale, Ohio.
Anderson, J. R.....	Macon, Ga.
Sayre, D. B.....	Wabash, Ind.
Thomas, L. A.....	Atlantic, Iowa.
Derwent, A. E.....	Durand, Ill.
Norton, M. T.....	Duluth, Minn.
Bown, T. A.....	Streator, Ill.
Bauer, G. L.....	Carlinville, Ill.
Richel, A. E.....	Vicksburgh, Mich.
Pierce, F. E.....	Los Angeles, Cal.
Stuart, J. T.....	Cleveland, O.
Mayne, H. D.....	Heuvelton, N. Y.
Girard, P. A.....	Benton, O.
Collins, B. J.....	Goshen, Ind.
Ramsey, S. V.....	Tuscola, Ill.
Slaght, Chas.....	Mason, Mich.
Risum, T. G.....	Bangor, Dak.
De Wolff, F. L.....	Sycamore, Ill.
Tilton, E. W.....	Oxford, Kan.
Smalley, L. F.....	Loudonville, O.
Roberts, C. A.....	Chicago, Ill.
Campbell, H. S.....	Edison, O.
Collins, A. H.....	Norwich, Ont.
Mayo, N. S.....	Ingham, Mich.

Lawton, E. W.....	Sheffield, Ill.
Huenink, C. J.....	Cedar Grove, Wis.
Klutz, L. M.....	Gold Hill, N. C.
Reed, J. W.....	Peru, Ind.
Pope, G. W.....	Lee, Mass.
Tyler, Allie.....	Hampshire, Ill.
Thomas, D. C.....	Osage, Iowa.
Wright, J. M.....	Wenona, Ill.
Myers, W. F.....	Fort Wayne, Ind.
Stark, J. M.....	Kingston, Ill.
Howard, T. B.....	Montpelier, Ind.
Hall, E. T.....	Bloomington, Ills.
Hall, H. N.....	Ayr, Nebraska.
Keller, W. F.....	Hastings, Nebraska.
Roberts, David.....	Franksville, Wis.
Smith, W. A.....	Sparland, Ills.
Morton, W. P.....	New Richmond, Wis.
Freeman, W. P.....	Stafford, Neb.

Rev. Dr. Utter distributed the prizes. Dr. John Anderson was awarded the prize in Materia Medica and Obstetrics; the prize in Pathology to Dr. E. W. Lawton, and in Anatomy to Dr. James Wright.

Numerous handsome bouquets, gifts from admirers, were also distributed among the students.

The class prophet, Dr. N. S. Mayo, then read an exceedingly clever rhyming production of his own composition which elicited great applause, and caused considerable merriment among the audience and his classmates.

Dr. D. C. Thomas delivered an able valedictory address, in the course of which on behalf of his class he bade a feeling farewell to his teachers, stating that the class of 1888-9 were dispersing to sixteen different States, and in all probability would never meet together again.

Health Commissioner De Wolff addressed the graduates, giving them some practical advice, and his genial words will be long remembered by the newly qualified men.

The Doctorate address by Professor F. S. Billings brought the exercises to a close.

The proceedings were enlivened at intervals with music by Lyons' orchestra and the Imperial Quartette.

OBITUARY.

CHARLES S. MOULTON, M.D., D.V.S.

We regret to announce the death of our colleague, which took place in the month of May, from heart disease, with which the doctor suffered for several years. He graduated at the American Veterinary College in 1882, and a few years after as M. D. from the Medical Department of the University of Michigan. Dr. Moulton carried on a lucrative practice in Washington and throughout the United States, where he had made a large number of friends. The following resolutions were passed by the Maryland State Veterinary Medical Association, of which he was a worthy and well appreciated member.

WHEREAS, It has pleased Almighty God, in His wisdom, to remove from our midst our friend and professional brother, Chas. S. Moulton, M.D., D.V.S., of Washington, D. C., who was one of the founders of this society, and who had ever taken an active interest in all that concerns the welfare of the veterinary profession.

Resolved, That we, the Maryland State Veterinary Society, deeply deplore his loss to the veterinary profession and especially to this society, and that we extend our heartfelt sympathy to his family in their bereavment.

Resolved, That these resolutions be spread upon the minutes of this society, and published in the AMERICAN VETERINARY REVIEW, the *Journal of Comparative Medicine and Surgery*, and the *Baltimore Sun*.

Resolved, That a copy of these resolutions be sent to the family of the deceased.

A. W. CLEMENT,
WM. DOUGHERTY,
C. K. DYER,

Committee.

CORRESPONDENCE.

VETERINARIAN WANTED.

COLUMBUS, Ga., April 29, 1889.

Editor Review :

I address you as an Eastern man from Massachusetts, who came here to spend the winter, and am well pleased with the climate and people.

I am a lover of good stock, and like to see the dumb animals well cared for when in need of medical attention, but am sorry to say of a place of 30,000 people, with six or eight livery stables, four dray lines, to say nothing of horses and other stock kept for private use, there is not a first-class veterinary surgeon within one hundred miles of this place. I have seen more horses and mules die here this winter than I ever saw in all my life in Massachusetts, and solely for the want of a first-class veterinary surgeon. The enclosed clip will give you some idea of the place and the amount of business done here.

Now if you know of a good veterinarian, one that is competent to fill such a want as this place requires, steady and reliable, you can secure for such a person a fine location by writing to Messrs. Jordan, of Empire Stables, who will do all in their power to aid such a person. The Messrs. Jordan are live men and of first-class character and reliable in whatever they say or do. As to their financial standing consult Bradstreet or other commercial reports. Unless you could put a good man upon this location, please do not put any.

Yours respectfully,

M. CRAVEN,

ANOTHER.

MOUNT HOLLY, N. J., April 3, 1889.

Editor Review :

DEAR SIR.—Do you know of any young veterinarian of ability? He should be a man both of ability and good char-

acter. If you know of any such person he will find that it will be very much to his advantage to locate here. If you will put us on the track of such a person, we can give him more points, and by so doing you will do us a great favor.

Yours respectfully,
PRICKITT & BARRINGTON.

ANOTHER.

ALEXANDRIA, MINN., May 30, 1889.

Dr. A. Liautard.

DEAR SIR.—Do you know of a good veterinarian that wants to locate and practice? I made the same inquiry of Dr. Valerius, and he referred me to you. Alexandria is a good place for a good man and we would help him all we could, but we don't want any 'quacks, for we have plenty of such now.

THOMPSON & COWEN.

STILL ANOTHER.

LEOMINSTER, MASS.

DEAR SIR.—There is a golden opportunity for a first-class veterinary surgeon in this town. We have six livery stables, six or eight jobbers and a number of nice driving horses, with a good driving park. This is one of the finest towns in the State. We have eight thousand inhabitants and are only five miles from the city of Fitchburg. A good veterinarian would soon secure a good practice if a first-class and a *sober* man.

HORSEMAN.

Now that the rush of the summer work is somewhat over, we desire to call attention to some matters looking forward to profitable work for the fall months, and through the winter. Write to B. F. Johnson & Co., 1009 Main St., Richmond, Va., and they will show you how to do a grand work, which can be made a *permanent thing*.